MONTHLY WEATHER REVIEW.

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VOL. XXX. MAY, 1902. No. 5

INTRODUCTION.

The MONTHLY WEATHER REVIEW for May, 1902, is based on reports from about 3,100 stations furnished by employees and voluntary observers, classified as follows: Regular stations of the Weather Bureau, 162; West Indian service stations, 13; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Railway Company, 96; Hawaiian Government Survey, 200; Canadian Meteorological Service, 33; Jamaica Weather Office, 160; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3; Costa Rican Service, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San Jose, Costa Rica; Capt. François S. Chaves, Director of the Meteorological Observatory, Ponta Delgada, St. Michaels' Azores; W. M. Shaw, Esq. Secretary, Meteorological Office' London; and Rev. Josef Algué, S. J., Director, Philippine Weather Service.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard of time is that of San Jose, $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

The storms of the north Atlantic were of moderate intensity. During the 15th and 16th a disturbance passed from west of Scotland over the North Sea. It increased in strength during the 17th and 18th, and on the morning of the 18th the reading of the barometer at Cuxhaven, Germany, was 29.28 inches. By the 19th the storm center had disappeared over the continent. The most important storm of the month over the British Isles covered the north of Scotland on the 28th, when the barometer read 28.96 inches at Stornoway, and 28.98 inches at Sumburg. During the 29th this disturbance disappeared east of Scotland. On the 31st the barometer read 29.58 inches at Lisbon, Spain, and a disturbance was apparently central over or slightly west of the Bay of Biscay.

No important storm occurred on the Atlantic seaboard or the Great Lakes of the United States after the first decade of the month. During the 6th and 7th a storm center passed north of east over the upper lakes and eastern Ontario attended by high winds that reached a reported maximum velocity of 48 miles an hour at Buffalo, N. Y. This storm was followed by a disturbance that passed rapidly from the British Northwest Territory to Lake Superior during the 7th and and 8th, and thence to the lower St. Lawrence Valley by the morning of the 9th, attended by winds that reached a velocity of 52 miles an hour at Chicago, Ill., 48 miles at Cleveland, Ohio, and Buffalo, N. Y., 60 miles at New York, N. Y., and 40 miles at Portland, Me. Storm warnings were displayed on the Great Lakes during the 8th, 9th, and 10th; advisory messages were telegraphed Atlantic ports from Hatteras, N. C., to Eastport, Me., on the 8th, and storm warnings were displayed on the New England coast during the 9th.

There was an unusual amount of frost in the northern tier of States, and in the Rocky Mountain and Plateau districts, and on the 27th snow was reported in the mountains of Maryland and western Pennsylvania, and in western and northern New York. Timely warnings were issued in the agricultural district in which frost occurred.

During the 17th, 18th, and 19th thunderstorms occurred from the States of the lower Missouri Valley to Texas, the severest storm of this period being reported at Goliad, Tex., where 200 people were killed and considerable property was destroyed.

The Weather Bureau forecasts conditions that favor the occurrence of thunderstorms; it is not possible, however, to define the localities in which storms of this general type will assume the form and acquire the intensity of tornadoes.

BOSTON FORECAST DISTRICT.

The gales of the early part of the month, and the frost that

occurred at intervals in the interior of New England, were successfully forecast.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

The following special warning was issued at 12:15 p. m. of the 18th: "Squalls, with brisk and occasionally high winds are indicated for the west Gulf this afternoon and to-night." Unusually severe squalls occurred Sunday afternoon and night over southern Texas and along the coast. At Goliad, Tex., a tornado killed 200 people and destroyed much property.—*I. M. Cline, Forecast Official.*

CHICAGO FORECAST DISTRICT.

No severe storms occurred on the upper lakes, and no mishaps of moment were reported. Frosts occurred in the western Lake region and in the Northwest several times during the month. Previous to their occurrence warnings were generally issued, and it is not thought that any serious damage resulted. There were a number of thunderstorms during the month, which caused an unusually large amount of rainfall in nearly all sections, making up to a large extent for the drought which prevailed during the fall and winter. These thunderstorms were almost invariably correctly forecast.—*H. J. Cox, Professor.*

DENVER FORECAST DISTRICT.

Special warnings were given distribution on the 18th for the heavy frost that visited Utah and western Colorado. Frosts that occurred in the agricultural districts on other dates, except in northern New Mexico, were generally covered in the daily forecasts.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

An area of high pressure off the central coast on May 17 and, at the same time, an extensive trough of low pressure over the Rocky Mountain region, were accompanied by high winds generally in California and Nevada. Especially in the vicinity of Point Reyes did the winds reach a high velocity; a maximum of 108 miles and an extreme velocity of 120 miles being reported at that station on the 18th.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

No severe storms occurred during the month. Frosts which, as a rule, were accurately forecast occurred frequently in the eastern sections from the 2d to the 5th, and occasionally until the close of the month.—*E. A. Beals, Forecast Official.*

RIVERS AND FLOODS.

The mean stages in the upper Mississippi River averaged from 2.5 to 5.5 feet higher than during the preceding month. They were also somewhat higher than during the corresponding period of the preceding year. The lower Mississippi, the Ohio, and the Tennessee, fell steadily, but remained at an excellent navigable stage at the close of the month.

The rivers of the East and South were lower, except the Brazos, where there was a considerable rise, due to heavy local rains. During the last days of the month there was also a sharp rise in the Arkansas River on account of continued heavy rains over its upper watershed, and some reports of flooding and damage were received from the Kansas portion.

West of the Rocky Mountains the feature of interest was the annual rise of the Columbia River which began on the 15th of the month. Its coming was well heralded, and ample time was afforded for all necessary preparations.

The highest and lowest water, mean stage, and monthly range at 138 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
High areas.										
I	*29, p. m.	50	100	4, p. m.	46	60	2,250	5.0	450	18.8
II	2, p. m.	41	124	7, a. m. / 8, a. m.	45 / 38	64 / 86	3,550 / 3,350	4.5 / 5.5	789 / 609	32.9 / 25.4
III	7, p. m.	54	114	12, p. m.	46	60	2,900	5.0	580	24.2
IV	12, p. m.	53	108	17, a. m.	32	65	2,875	4.5	639	26.6
V	20, a. m.	48	86	23, a. m.	32	65	1,900	3.0	633	26.4
VI	24, p. m.	54	114	30, a. m.	36	76	2,450	5.5	445	18.6
VII	30, a. m.	48	86	31, p. m.	41	70	900	1.5	600	25.0
Sums							20,175	34.5	4,745	197.9
Mean of 8 paths							2,522		593	24.7
Mean of 34.5 days									585	24.4
Low areas.										
I	*30, a. m.	41	112	4, a. m.	32	65	3,350	4.0	838	34.9
II	2, p. m.	38	105	6, a. m.	46	60	2,700	3.5	771	32.1
III	5, p. m.	41	97	7, p. m.	48	68	1,600	2.0	800	33.3
IV	6, p. m.	32	94	8, a. m.	35	76	1,050	1.5	700	29.2
V	6, p. m.	54	114	10, a. m.	46	60	2,550	3.5	728	30.3
VI	17, a. m.	46	106	20, p. m.	51	104	2,000	3.5	571	23.8
VII	25, a. m.	42	83	28, a. m.	48	68	975	3.0	325	13.5
Sums							14,225	21.0	4,733	197.1
Mean of 7 paths							2,032		676	28.2
Mean of 21.0 days									678	28.2

*April.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk, Forecast Division.*

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Divison.

The following summaries relating to the general weather and crop conditions are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau:

Alabama.—Conditions favorable for cultivation, but generally too dry for late planted staple crops, particularly so in some northern counties, where a drought, which began about April 17, continued practically unbroken.—***Frank P. Chaffee.***

Arizona.—Unseasonably cold weather, extreme aridity of the atmosphere, high, drying winds, and an insufficient supply of water in the irrigated districts, combined to produce very unfavorable conditions for plant development during the month. The quality of the hay crop was below the average. The ranges had a scanty supply of feed and water, and were deteriorating at close of month.—***Wm. G. Burns.***

Arkansas.—The weather conditions during the month were generally favorable for farming operations, and work progressed rapidly. Corn planting was completed in some localities during the first week, and was completed in all sections by the close of the month. The early planted had generally come up to good stands and cultivation was well under way; some had been laid by during the last week. Cotton had begun to come up by the second week and was being chopped out in many sections;

its growth was retarded by the cool nights about the middle of the month, but during the third week it was making vigorous growth, which was again checked during the closing days of the month by the general rains and abnormally low temperatures; some fields were badly in grass, but on the whole, the crop was in good condition. Wheat and oats had improved, and generally were in good condition; some were ripening and heading, and harvesting had begun in localities. Potatoes generally were in good condition and marketing had begun. Fruits of all kinds presented fair prospects, although peaches and apples had commenced to drop in some sections.—*Edward B. Richards.*

California.—The temperature was below normal nearly all the month, and the development of fruit and grain was somewhat retarded. High winds from the 16th to 19th caused slight damage to deciduous fruits, and grain and hay were slightly damaged by rain. Crop prospects continued good in most places north of the Tehachapi. Fruit prospects were very good, except prunes and pears in some localities.—*Alexander G. McAdie.*

Colorado.—For the State as a whole the weather conditions during May were unfavorable. In the northeastern counties where precipitation was timely vegetation made normal advancement; elsewhere the month was marked by a drought of more or less severity. In the western counties the lack of rainfall was not seriously felt, while in San Luis Park, the Arkansas Valley, and the counties near the eastern foothills the scarcity of water for irrigation was as pronounced as occurs occasionally late in summer, and vegetation generally made little or no progress; replanting of beets became necessary in localities, and plowing for corn and potatoes proceeded slowly in the dry soil. Fortunately, the much needed moisture came before vegetation was past reviving. About the middle of the third decade showers occurred over the greater part of the State, the precipitation being unusually copious in the southern counties where the drought had been of long standing. The month closed with a good outlook for the majority of crops, good pasturage assured, and indications for an excellent fruit crop.—*F. H. Brandenburg.*

Florida.—The month was dry and, to a large extent, unfavorable to crop growth, although farm work was prosecuted with energy and the close of the month found all crops about free of grass. Cotton made good progress, as a rule, and the early planted took on considerable fruit. Corn suffered severely. Peaches were small and rather inferior. Pineapples were late, and fruit will be small if dry weather persists much longer. Citrus fruits have suffered much damage; quite half the crop in some sections has been lost. As yet but a small acreage has been set to sweet potatoes.—*A. J. Mitchell.*

Georgia.—The temperature was decidedly above the normal. A very warm period occurred from the 3d to the 7th, inclusive, and a cool period from the 27th to the 30th, inclusive. The rainfall for the State at large was deficient, notably so in the northwestern counties, where the monthly totals were under 1 inch. Over the southern half of the State the precipitation was unevenly distributed; it was in excess of the usual amount in a few counties, mainly in the south-central portion. The weather was favorable for farm work and the cultivation of crops, and the latter were in good condition at the close of the month with respect to cultivation. Cotton and corn made good progress and were unusually promising. The dry weather caused short yields of wheat and oats. Fruit prospects were not flattering.—*J. B. Marbury.*

Idaho.—A very favorable month for growth of all crops, and at its close the prospects were excellent for large yields of alfalfa, timothy, crimson clover, fall and spring sown wheat, and oats. Apple, prune, and pear trees were heavily laden. There was a cold, frosty period from the 16th to 20th, during which the temperature fell below the freezing point in many sections.—*S. M. Blandford.*

Illinois.—The month of May was generally warm, though there were periods of cool weather, during which light frosts occurred. These, however, caused no material injury to vegetation. Good rains occurred during the month over most of the State; some localities, especially in the northern district, received such heavy rains as to interfere considerably with farm work, while in a few others the rain was too light to meet the requirements of vegetation. As a result of the favorable conditions crops of all kinds have made good growth, and their condition at the end of the month showed a decided improvement over that at the beginning. The fruit prospects were not favorable generally, but in some localities they were good.—*M. E. Blystone.*

Indiana.—Frequent rains in the northern section delayed field work more or less throughout the month, and general rains from the 19th to 25th interrupted corn planting and plowing in all sections, and in some of the southern counties damaged corn and other crops by washing and inundation. Frosts on the 27th, 28th, and 29th damaged garden truck materially and corn slightly in the northern and central sections. Corn planting and replanting were completed during the month, except in the northern section where the ground had been too wet, and in a few other localities where the first planting had been destroyed by cut worms or washing rains. Wheat improved, but promised only a light crop. At the close of the month rye was in excellent condition and heading; oats, clover, potatoes, and all minor field crops were doing very well.—*W. T. Blythe.*

Iowa.—The month was warmer than usual with more than the normal amount of rainfall, with very unequal distribution, the range being from less than an inch to more than 18 inches. Frequent rainy days interrupted farm work, and the period of corn planting was extended practically through the month; but a large acreage was planted and germination was generally quick and satisfactory. A good stand of corn was secured, with not more than usual replanting. Small grain and grass made very vigorous growth in all portions where there was ample moisture. On the whole May was a favorable month for crops.—*John R. Sage.*

Kansas.—Month warm and wet and favorable to crop growth. Wheat improved rapidly, and by close of month early wheat in the south was ready to harvest. Corn was a good stand and grew rapidly, but was getting weedy, with ground too wet to cultivate. Oats and grass greatly improved. Alfalfa cutting interfered with by wet weather.—*T. B. Jennings.*

Kentucky.—The month was fairly favorable and growing crops advanced well. No damaging conditions of any extent were reported. About half the tobacco crop was set by the end of the month and started off well. Plants were scarce in the central and eastern portions of the State. The planting of corn was finished and the crops progressed fairly well. Wheat improved slightly, but only about half a crop can be expected; oats and rye were in fairly good condition. Gardens and potatoes were doing well. Fruit was not promising; there were few peaches and apples were dropping badly.—*H. B. Hersey.*

Louisiana.—The weather during the month was generally favorable for farming operations. Cotton planting was completed, and good stands were secured generally; cultivation kept pace with the growth of the plant; early cotton was forming squares and blooming over the central and southern portions of the State at the close of the month. Sugar cane made good growth, and the crop was kept in a good state of cultivation. Rice seeding was completed during the month and good stands were secured generally. Early rice had commenced heading at the close of the month. Corn made good growth, and the bulk of the crop was plowed the last time.—*I. M. Cline.*

Maryland and Delaware.—The several periods of quite low temperatures, and the prevailing dryness, were hurtful to all crops. Corn did well, however, and clean fields and good stands were generally reported; at the end of month early wheat promised ordinary to fair returns, but late sown wheat was everywhere poor and thin; oats and rye were in poor condition; grasses suffered from the drought. Tobacco transplanting was accomplished as "seasons" permitted, and about half the crop was out; the stands were uneven on account of plants dying in the field. Fruit prospects deteriorated greatly in the west, but were fair in the eastern counties for peaches, but less satisfactory for apples, pears, and plums. All garden truck was hurt by the dry spell; potatoes held up fairly well; strawberries and peas yielded poorly. The 17-year locusts appeared in many localities, and did some damage to young fruit trees.—*Oliver L. Fassig.*

Michigan.—The month was generally favorable for the growth of crops and the germination of spring seeding, but frequent and abundant showers interfered more or less with field work. The first half of the month was rather cool, and frosts of more or less severity occurred during all three decades, but the damage was generally very light. The condition of winter wheat, rye, meadows, and pastures improved steadily throughout the month. Oat seeding germinated nicely, and at the close of the month oats were in promising condition. Peas and barley also germinated nicely and were doing well. Sugar beet seeding was general after the first week of the month; at the close of the month the beets had mostly germinated, and thinning and cultivation were in progress. Early potatoes were mostly planted by the 10th, and at the close they had germinated nicely and were being cultivated. Corn planting was well under way by the middle of the month, and by the 20th the bulk had been planted; it germinated slowly, but came up nicely and was attaining a good stand at the close of the month. Fruit of all kinds continued promising throughout the month, not having suffered any damage from frosts.—*C. F. Schneider.*

Minnesota.—The western parts of Marshall, Polk, and Norman counties, in the Red River Valley, continued very wet till after the middle of the month and no work was possible; considerable wheat was sown on these lands for a few days after the 22d, and then barley, oats, flax, and potatoes were put in. In other parts of the State the soil was in excellent condition most of the month and all the small grains grew well and stooled satisfactorily. Rye was headed late in the month, and winter wheat was heading. Most of the corn and potatoes were planted and before the end of the month they were being cultivated. Flax seeding went on all the month on new land; the early sown was growing nicely. The hay crop promises to be a large one. The middle of the month was showery and cool. There was considerable snow in northern portions on the 9th, and there were frosts on the morning of the same date, but without injury.—*J. T. Outram.*

Mississippi.—The rainfall was poorly distributed, being heavy in the southern and extreme western counties and deficient in the northeastern portion of the State. The planting of cotton was completed during the first of the month, but owing to the dryness of the soil the seed germinated slowly; however, by the close of the month the late planted cotton was up and being chopped to stands. Early planted cotton was kept clean and generally made a vigorous growth; squares were commencing to form. Corn did well throughout the month and during the last week

was beginning to tassel. Where moisture was sufficient oats did fairly well, but, on the whole, they deteriorated. Minor crops made a satisfactory growth. Gardens yielded well.—*W. S. Belden.*

Missouri.—Except in a few of the northern and eastern counties, where a deficiency in precipitation retarded the growth of oats, pastures, and meadows, the weather conditions during the month were, on the whole, very favorable to the farmer. Corn came up to good stands and made good progress. Wheat continued unusually promising, though there was some complaint of rust and lodging, and oats did well, as a rule. Meadows improved rapidly during the latter part of the month, but many old meadows were very weedy. Cotton, flax, rye, and all minor crops made good growth, but the outlook for the apple crop was not encouraging; many orchards in the northern counties were defoliated by caterpillars and in the central and southern sections there was complaint of dropping.—*A. E. Hackett.*

Montana.—The weather was favorable for growing crops throughout the State, except in Carbon County, where a drought prevailed, the ground being so dry that the grain sown would not germinate.—*E. J. Glass.*

Nebraska.—May was a most favorable month for the growth of all vegetation, being warm with an excess of precipitation, which came in gentle all day rains, without high wind, in nearly every instance. Winter wheat improved wonderfully, while oats and grass made excellent growth. Potatoes developed so well as to indicate a large crop. The fruit with the exception of apples did not recover from the effects of the unseasonable weather of April.—*G. A. Loveland.*

Nevada.—The temperature throughout the month was about normal, but the precipitation was quite deficient all over the State, being about one-third of the usual amount for May. Damaging frosts occurred during the first and second decades, doing more or less damage to alfalfa, fruit buds, and garden truck in various parts of the State. Range feed was fairly good, and livestock improved in condition. At the close of the month all crops were looking well, but very backward.—*J. H. Smith.*

New England.—The weather of the month, generally considered, has not been the most favorable for crops and farm work. In the northern part of the section there was an excess of rainfall, which delayed planting and the growth of crops; in the southern portion there was a deficiency of rainfall, and in some parts it was hardly appreciable, the absence of needed rainfall dwarfing the growth of grass and crops. Cool nights prevailed throughout the month, with frosts, which did more or less damage to fruit, and delayed the growth of vegetation.—*T. L. Bridges.*

New Jersey.—Owing to the great deficiency of rainfall and low night temperatures vegetation generally has made slow progress. Freezing temperature on the morning of the 29th did great injury to tender vegetation, especially in Ocean and Burlington counties.—*Edward W. McGann.*

New Mexico.—Precipitation confined mostly to the mountains. Until the latter part of month a severe drought prevailed over the plains, especially in the northeast, which was favorable to the lambing season in those sections, but planting was much delayed.—*R. M. Hardinge.*

New York.—Great extremes of temperature with killing frosts on 10th, followed by several frosty nights and heavy frosts in places on 29th. Early garden truck and fruit greatly damaged, especially peaches, cherries, plums, and early apples and pears. Late apples and grapes suffered but little. Weather for first twenty days was too cool and dry, followed by warm weather for a few days, but it was again cool by the end of the month. The month was favorable for work, but too dry for hay, which, however, was improved by later rains.—*R. G. Allen.*

North Carolina.—Conditions during May were very suitable for the advancement of farm work, as well as favorable for the growth of crops. The temperature was above normal until the last week, when a rather sharp, cool period occurred from the 27th to 30th, which checked the growth of vegetation and gave plants an unhealthy appearance in some sections. Light frosts were general in the mountain region on the 28th, 29th, and 30th, with some damage to tender vegetation. There was a tendency to drought in many counties during the month, but while the rainfall was considerably below the seasonal average, light showers were so frequent that the staple crops did not suffer materially from lack of sufficient moisture; still transplanting tobacco was delayed at many places by lack of "seasons" at the proper moment, and dry weather toward the close of the month caused late cotton to come up poorly. Crops were maintained in a high state of cultivation, and were quite free from grass and weeds.—*C. F. von Herrmann.*

North Dakota.—Seeding was interrupted and retarded during the fore part of the month by heavy rains, low ground being so flooded that it could not be worked. The latter part was more favorable, and most of the crops had been planted at the close of the month, except flax, which was only about half in. Owing to its wet condition, considerable area of land in river bottoms was not seeded.—*B. H. Bronson.*

Ohio.—The temperature for May was slightly above normal. The hottest weather occurred from the 19th to the 22d, and the coldest days were the 10th, 28th, and 29th. The precipitation was deficient in central districts and in excess in the extreme north and along the Ohio River. The accumulated deficiency at Columbus since January 1, 1902, is 8.86 inches. High winds have been frequent during the month. The general condition of crops at the end of the month was but fair. Wheat was heading low and many fields were thin on the ground; oats were growing slowly; rye and barley were doing well; corn was uneven, due to cool weather and damage by cutworms; pastures were poor, and grass fields and meadows were generally short; a light hay crop was indicated; fruit in general was in poor condition.—*J. Warren Smith.*

Oklahoma and Indian Territories.—Frequent and heavy rains during the month were beneficial to the crops, but caused considerable damage on lowlands; wheat made a good growth, and the early soft wheat had matured and was ready to harvest at the close of the month; corn and cotton made a rapid growth, and generally were up to good stands but needing cultivation; oats, barley, and rye were in fine condition and well headed; potatoes were matured, with a large crop in prospect; kaffir and broom corn, cane, millet, grass, stock, and gardens doing well.—*C. M. Strong.*

Oregon.—Vegetation in general made satisfactory advancement during the month, but the weather was too cool for the best development of grain and the rapid growth of garden truck. Light frosts were of frequent occurrence, but, as a rule, they did little or no damage. At the close of the month fall wheat had begun to head and, although quite weedy, was generally thrifty and promising.—*Edward A. Beals.*

Pennsylvania.—The rainfall for the month was less than 2 inches over the eastern half of the State and from 2 to 4 inches over the western half. Droughty conditions, especially over the eastern half, began to injuriously affect agricultural interests during the latter part of the month. Damaging frosts occurred on the 28th and 29th and considerable injury was done to small fruit and tender vegetables.—*T. F. Townsend.*

Porto Rico.—Agricultural interests generally have suffered injury and some material loss from the heavy and continuous rains of the month, especially during the latter half, when practically all farming operations had to be suspended. Mature canes could not be cut, the juice deteriorated in quality and the young ratoons were seriously damaged, although the young canes already well established seem to have made some advance. Some tobacco was cut and seeds gathered for the new planting, but the growing plants were greatly damaged by the weather. The coffee trees, though quite promising up to the middle of the month, began to shed their berries, owing to the heavy rainfall, and by the end of the month the prospects for the new crop were not so bright. For the same reason, the orange trees began to prematurely shed their blossoms, thus endangering the new crop. The cultivation of small crops was carried on as the weather would permit.—*E. C. Thompson.*

South Carolina.—The temperatures were favorable until near the close of the month, when unseasonably cool weather, with light frosts in the western portion, slightly checked growth. The rainfall was deficient over the western half of the State and along the immediate coast. Destructive hailstorms occurred on the 3d and 25th, and destructive winds on the 25th. The condition of corn, cotton, tobacco, and rice was very good, owing to the favorable weather, while in places it was too dry for maturing wheat and oats. Harvesting the latter grain made fair progress. Fields were well cultivated and generally free from grass and weeds. Peaches, pears, and apples dropped to a considerable extent, impairing the previous favorable prospects for a large fruit crop. Truck continued to come to maturity and extensive shipments were made. The general crop prospects were very bright at the close of the month. Stands of corn were damaged by worms, but stands of cotton were nearly perfect.—*J. W. Bauer.*

South Dakota.—A storm of tornadic character, with a funnel-shaped cloud, formed on the 17th in northwestern Faulk County and passed northeastward into southeastern Edmunds County, in its progress killing one child, destroying some unoccupied and isolated buildings, two farm dwellings, several barns, and injuring some cattle. Except that corn planting was somewhat delayed by rains and the growth of this crop was kept a little behind the season by cool nights and consequently cool soil, the weather conditions were generally favorable for all vegetation, especially small grains and grasses, and at the close of the month the general crop outlook was very gratifying, although the stand in some fields of corn had been somewhat reduced by cutworms. There was frost in eastern sections on the 27th, generally light, but no material injury resulted therefrom.—*S. W. Glenn.*

Tennessee.—The first week of the month was warm and humid, and vegetation made very rapid growth. The weather continued warm and favorable for agricultural interests until about the 24th, when a cool spell set in and lasted until the end of the month; light frosts were reported on the 27th and 28th in the highlands, but without material damage. At the end of the month corn was in fine condition; cotton was also promising a good crop; tobacco was mostly transplanted and doing well; wheat was ripening, with indications of a very poor yield; apples were reported scarce, and peaches were falling off badly.—*Roscoe Nunn.*

Texas.—The weather during the month was quite favorable to all agricultural interests throughout the State, and the growth and development of vegetation was unusually rapid. At the close of the month the cotton crop was never in better condition; the early planting was generally in bloom, and that seeded late was up to excellent stands and forming squares. The progress of corn was highly satisfactory until the last decade of the month, when the general condition of this crop was somewhat lowered on account of the lack of sufficient moisture. The harvesting of wheat and oats became general about the second decade, and at

the close of the month much of this work had been completed, and considerable thrashing had been done. While the quality of these crops was good the yield was much below the average. The marketing of fruit and melons began early in the month, and the yields from these crops were very satisfactory. A marked improvement was noted in the condition of ranges, and stock did exceptionally well.—*Edward H. Bowie.*

Utah.—The low temperatures from the 18th to 21st did considerable damage to fruit and tender plants in localities of the middle and southern sections. On the whole, crops did well and were in good condition at the close of the month.—*L. H. Murdoch.*

Virginia.—The progress of crops throughout the month was retarded by occasional unseasonably cool weather and want of moisture. Field work advanced rapidly. Fall sown crops made little improvement, wheat heading low and winter oats being practically a failure. Spring oats and corn did well. A portion of the tobacco crop was transplanted, some of which was killed by subsequent unfavorable weather.—*Edward A. Evans.*

Washington.—The month was pleasant and favorable for crops, although cold rains injured several kinds of fruit, and it was a little too wet for potatoes on the lowlands. The abundant rainfall in the eastern section was very favorable for wheat and other small grain, as well as clover and alfalfa. Most crops were doing well, though later than usual, owing to cool and unfavorable March and April weather.—*G. N. Salisbury.*

West Virginia.—The low minimum temperatures of the 9th and 10th, together with the dry weather, were rather unfavorable for crop growth. The good rains of the 24th and 25th revived crops, and at the close of the month wheat, rye, and oats were doing fairly well, but wheat was short and thin on the ground, and the prospect was for not more than half a crop. Meadows and pastures were improving, but a light yield of hay was expected. Potatoes were growing well and were very promising. The prospects were for rather poor crops of apples and peaches, as they were dropping considerably. During the last week locusts made their appearance in Boone and Berkeley counties.—*E. C. Vose.*

Wisconsin.—The month was characterized by heavy and almost continuous rains, especially in western and central counties, where the total monthly precipitation exceeded 10 inches. In the northern and eastern counties the rainfall was copious but not excessive. Corn and potato planting was delayed by the rains until near the end of the month. Winter wheat, rye, oats, and barley made very rapid growth, and meadows gave promise of a heavy hay crop. The condition of the apple crop declined somewhat toward the end of the month on account of blight. Small fruits generally promise a good yield.—*W. M. Wilson.*

Wyoming.—Except over a few sections of the State where the rainfall was very deficient the month was favorable for the range, but by the close of the month a good general rain was needed. Grain, meadows, and alfalfa made good growth. The general snow and rain of the 19th was severe on lambs and many perished, although the loss was comparatively small, and was more than compensated for by the benefit which the range received from the storm.—*W. S. Palmer.*

In the following table are given, for the various sections of the climate and Crop Service of the Weather Bureau, the mean temperature, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

Summary of temperature and precipitation by sections, May, 1902.

Section.	Temperature in degrees Fahrenheit.								Precipitation in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	75.4	+3.7	Gadsden	100	26	Hamilton	42	28	2.34	−0.86	Flomaton	7.65	Hamilton	0.41
Arizona	69.7	−1.3	Aztec	111	29	Ashfork	17	20	0.31	+0.02	Showlow	2.07	Number of stations.	0.00
Arkansas	73.2	+3.1	Arkadelphia	100	22	Witts Springs	44	1	4.34	−0.57	Rosadale	8.44	Batesville	1.73
						Wiggs		8						
California	60.8	−2.4	Imperial	113	28	Bodie	10	2, 20	0.84	−0.24	Crescent City	6.29	24 stations	0.00
Colorado	55.1	+0.9	Blaine	96	2	Breckenridge	11	6	2.34	+0.35	Wray	7.00	Buena Vista	0.10
Florida	77.7	+2.1	Macclenny	101	26	Lake Butler	51	7	2.45	−0.46	St. Andrews Bay	7.81	Titusville	0.27
						Wausau		29						
Georgia	75.5	+3.8	Millen	102	3	Alpharetta, Ramsey	41	28	2.34	−0.87	Waycross	6.65	Canton	0.29
Idaho	53.1	−0.4	Garnet	103	27	Burnside	16	19	1.95	+0.13	Priest River	5.18	Garnet	0.16
Illinois	65.9	+3.9	St. John	97	20	Sycamore	32	15	4.28	+0.28	Mattoon	11.00	Morrisonville	1.02
Indiana	66.3	+3.4	Vincennes	98	18	Connersville	29	8	4.32	+0.46	Paoli	9.31	Evansville	1.36
			Washington		20, 22									
Iowa	63.8	+4.1	Sigourney	97	20	Cresco	25	10	5.39	+1.42	Grand Meadow	18.04	Washta	0.87
Kansas	68.4	+3.9	Hays	101	2	Eureka Ranch	35	7	6.64	+2.81	Fredonia	11.40	Ness City	2.37
Kentucky	70.0	+3.5	Paducah	98	20	Anchorage	35	28	3.55	−0.40	Frankfort	6.53	Henderson	1.37
			Hopkinsville		23									
Louisiana	76.9	+2.7	Collinston	98	25	Farmerville	46	8	3.54	+0.39	Alexandria	9.09	Port Eads	1.09
			Covington		26									
			Lafayette		28									
Maryland and Delaware	63.9	+1.2	Boettcherville, Md.	98	20	Deer Park, Md.	22	10	2.68	−1.94	Deer Park, Md.	4.76	Taneytown	0.73
Michigan	55.4	+1.0	Allegan	92	18	Humboldt	14	8	3.25	+0.83	Gaylord	8.80	Ewen	0.70
			Plymouth		19									
			Stanton		22									
Minnesota	57.0	+2.0	Pokegama Falls	95	19	Warroad	17	1	5.10	+2.50	Caledonia	11.13	Wyoming	2.57
Mississippi	76.2	+3.7	Aberdeen	100	25	Corinth	45	28	2.81	−0.42	Pearlington	6.82	Palo Alto	0.49
Missouri	69.4	+4.6	Poplar Bluff	98	25	Ironton, Potosi	39	28	5.03	.00	Wheatland	9.93	Marble Hill	1.64
Montana	53.4	+0.8	Billings	94	29	Custer	17	5	3.56	+1.35	St. Peters	6.62	Dell	0.42
Nebraska	63.3	+3.6	Franklin	102	3	Fort Robinson	28	5	4.14	+0.62	Holdredge	10.08	Lyons	0.75
Nevada	53.7	−1.0	Rioville	102	28	Monitor Mill	16	2	0.37	−0.86	Lee	1.46	Several stations	0.00
New England	54.1	−1.2	Nashua, N. H	92	23	Chelsea, Vt	19	10	2.63	−1.17	Stratford, N. H	5.43	Nantucket, Mass.	0.74
New Jersey	60.3	−0.3	Bridgeton, Paterson	95	23	Layton	29	14	2.04	−2.46	Rivervale	4.63	Layton	1.11
New Mexico	62.5	+1.1	Carlsbad	102	24	Winsors	24	22	1.12	+0.14	Folsom	3.82	3 stations	0.00
New York	54.5	−1.0	Primrose	92	23	4 stations	17	10, 11	2.89	−1.16	Adams Center	6.16	Southampton	0.80
North Carolina	69.5	+2.4	Southern Pines	99	6	Brevard	31	31	2.59	−1.61	Tarboro	4.83	Morganton	0.62
North Dakota	55.9	+4.6	Coal Harbor	94	29	Milton	24	8	3.57	+1.15	Milton	4.98	McKinney	0.78
			Minot		30									
Ohio	62.6	+1.7	Plattsburg	98	21	Hillhouse	24	10	3.09	−0.48	Rocky Ridge	8.92	Lima	0.87
Oklahoma and Indian Territories	71.2	+2.0	Goodwater, Ind. T.	101	25	Kenton, Okla.	40	1	10.13	+4.51	Blackburn, Okla.	20.18	Tahlequah, Ind. T.	3.42
Oregon	54.8	−0.7	Pine	102	27	Bend	17	19	2.68	+0.01	Glenora	7.84	Vale	0.39
Pennsylvania	59.8	+0.2	Wilkesbarre	95	23	Saegerstown	25	10	1.96	−2.89	Warren	4.45	Harrisburg	0.29
						Dushore	56	14						
Porto Rico	77.9	.....	Bayamon	96	10	Barros		9	13.78	+4.22	La Marias	31.78	Aguine	3.96
South Carolina	74.0	+2.4	Blackville	101	4	Liberty / Health Springs	42	29	2.69	−0.67	Temperance	6.53	Liberty	0.29
South Dakota	69.1	+3.0	Cherry Creek	93	13	Leola	26	10	2.83	+0.10	Ipswich	8.35	Pierre	0.81
			Ipswich		28									
Tennessee	71.6	+4.0	Bolivar	98	22	Rugby	32	28	2.90	−0.77	Clarksville	7.09	Lafayette	1.21
Texas	75.8	+2.5	Fort McIntosh	110	19	Tulia	38	6	3.93	+0.09	Wichita Falls	11.05	El Paso	T.
Utah	56.2	−0.5	Green River	99	29, 30	Tropic	13	21	0.64	−0.41	Huntsville	2.24	4 stations	T.
Virginia	66.5	+1.9	Lincoln	98	24	Burkes Garden	29	10	2.84	−0.93	West Point	4.70	Farmville	1.30
Washington	55.4	0.0	Pasco	96	26	Cle Elum	28	4	2.52	.00	Clearwater	6.44	Ellensburg	0.66
						Moxee		18						
West Virginia	65.2	+2.6	Cairo	98	13	Terra Alto	25	10	3.17	−1.17	Pickens	6.09	Cairo	1.30
			Glenville		22									
Wisconsin	57.9	+1.9	Buttermut / Grantsburg	92	18	Koepenick	24	9	5.79	+1.97	Prairie du Chien	11.84	Hayward	1.28
Wyoming	52.5	+0.9	Hyattville	93	30	Leo	10	20	1.40	−0.50	Fort Laramie	3.61	Centennial	0.16

SPECIAL CONTRIBUTIONS.

STUDIES ON THE STATICS AND KINEMATICS OF THE ATMOSPHERE IN THE UNITED STATES.

V. RELATIONS BETWEEN THE GENERAL CIRCULATION AND THE CYCLONES AND ANTICYCLONES.

By Prof. FRANK H. BIGELOW.

UNEQUAL DISTRIBUTION OF CYCLONES IN NORTH AMERICA AND EUROPE-ASIA.

We have arrived at the following proposition as the result of the discussion of Ferrel's and Oberbeck's analysis of the general and local circulation, that the general cyclone and the local cyclones and anticyclones have been treated almost independently of one another, while in fact the imperfect results of the theory and the modern observations both indicate that these two classes of movement should be analyzed in close relation with each other. The evidence compels us to regard both these circulations as the common effect of the readjustment of the thermal equilibrium, which is disturbed by the radiation of the sun falling on the tropic zones, and the true meteorological problem is to trace out the successive stages in the process of this interaction through the resulting currents which circulate in the atmosphere. The results contained in this paper apply especially to the North American Continent, and it is hardly to be expected that the details will be found the same in all the other regions of the earth. Indeed there are several reasons for believing that this continent is the peculiar theater for the interchange between the heat and the cold of the Northern Hemisphere, and that the Euro-Asian Continent plays a very different role in the meteorological economy of this hemisphere. For it is well known (1) that while the American Continent is the place for the profuse generation of cyclones, Europe is the region for their dissipation, and in Asia very few cyclones occur except along the ocean borders; (2) that the velocity of motion of the atmosphere generally is about twice as great over North America as over Europe. This points to a profound difference between the actions of the atmosphere in these two regions, but one cause of it at least is easily perceived. It has been shown that the currents which are especially concerned in forming cyclones are contained for the most part within 2 or 3 miles of the ground, though their accompanying effects may extend much higher. Hence, any barriers of elevated ground, as mountain ranges, which tend to deflect the flow of the lower strata, must strongly influence the formation of the cyclones themselves, if they are to be referred to the counter flow of long horizontal currents of different temperature rather than to local vertical convective currents.

The great range of the Himalaya Mountains stretching east and west is such a barrier to the flow of the tropical and polar currents in that region, and the result is that true cyclonic movements are almost excluded from the interior of Asia. On the other hand the Rocky Mountain range, stretching north and south along the western districts of North America, favors the counter flow from the Tropics and the polar regions by deflecting the westward current of the Tropics toward the north, and the eastward drift of the higher latitudes toward the south. The same tendency is favored by the location of the high pressure belt in the latitude of 35°, which causes a high pressure area to form over the middle Atlantic Ocean, while the Rocky Mountain range breaks through the midst of it. The result is to produce a powerful anticyclonic center of action over the Atlantic Ocean, which produces a strong northward component from the West Indies toward the interior of the continent. At the same time the American Continent causes the isobars and isotherms to loop southward, and thus in consequence to draw the Siberian atmosphere in a direction nearly parallel to the Rocky Mountain range. These physical conditions are a constant incentive to the formation of countercurrents which meet on the Canadian and United States territory, with the result that 75 per cent or 80 per cent of the storms of the Northern Hemisphere are generated in these districts. It is not necessary for maintaining the temperature equilibrium of the hemisphere that the interchange of heat and cold should occur so as to have a uniform distribution over all portions of it, because if there is an excessive interchange in any place, as in North America, the general movements of the atmosphere will soon transfer the effects to all other parts. Keeping these facts in mind will facilitate an understanding of the views which will be briefly described as follows:

CRITICISM OF THE CANAL THEORY OF THE GENERAL CIRCULATION.

The immediate problem before us is this: To what extent is the canal theory of the general circulation over a hemisphere correct, and in what direction must it be modified to conform to the modern observations? Ferrel derived the following equations from a discussion of the first equation of 397a for the approximate velocities and gradients in the strata of the upper atmosphere:

$$408a.\quad \text{Velocity;}\quad v = v_0 - \frac{0.016}{(2n+\nu)} \cdot \frac{gh}{r} \cdot \frac{A_2 \sin\theta}{(1+at)};$$

$$409a.\quad \text{Gradient;}\quad G = G_0 - \frac{0.00001327}{\cos^2 i} \cdot \frac{A_2 \sin 2\theta}{(1+at)^2} \cdot \frac{P}{P_0} h;$$

when $v_0\ G_0\ P_0$ are the values at the surface, and v, G, P, the values at the height h. Since A_2 is negative, $-20.95°$, it follows that v is greater than v_0, and G is greater than G_0, so that the eastward velocity and the meridional gradient velocity increase with the height. The relative eastward velocity is shown on fig. 16. The interchanging velocity along the meridians is northward above the neutral plane and southward below it as given on fig. 16.

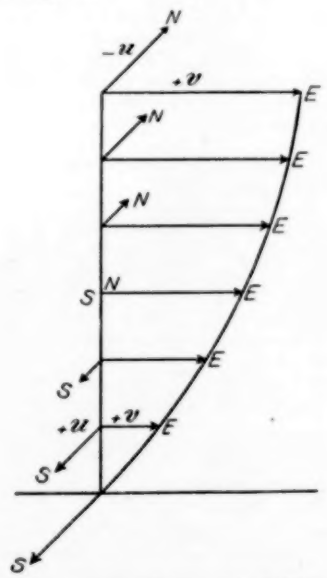

FIG. 16.—Ferrel's component currents by the canal theory.

The canal theory requires that the flow of the atmosphere should be in unbroken stream lines conforming to these precepts. The result of the principle of preservation of areas, $v\,\varpi =$ constant, as applied to the axis of rotation of the earth, is that the velocity v is excessive near the poles, and the gradients of the upper strata much too large. Ferrel sought to escape this difficulty by evaluating $\Sigma m\ (v - v_0)\ k$ for the upper strata with a northward $-u$, and $\Sigma m\ (v - v_0)\ k$ for the lower

strata with a southward + u, and assuming that the difference of momenta is equal to the retardation of the eastward drift by the frictional resistance. It is known, however, that the frictional coefficient is a very small factor, and not capable of producing the required retardation.

Furthermore, the modern observations show, as in Paper III,[1] that the northward — u, and the southward + u, components are not distributed as the canal theory requires, but that there are approximately equal currents flowing northward and southward *on the same levels*, which reduces the difference of momenta to zero, and is fatal to the frictional theory of retardation. The counter flow of horizontal currents on the same levels, most powerful in the strato-cumulus level, does, however, constitute a dynamic mechanism quite capable of retarding the eastward drift, so as to produce the observed moderate eastward velocities of the temperate zones. This is the true source of the energy consumed in the motions of cyclones and anticyclones. Compare fig. 17.

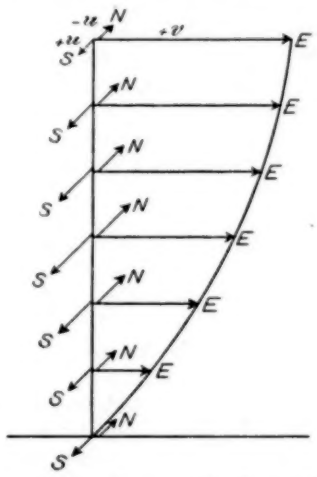

FIG. 17.—Bigelow's component currents from the Weather Bureau observations.

The general theory which has already been mentioned in my previous paper—Storms, Storm Tracks, and Weather Forecasting, Bulletin No. 20, Weather Bureau, 1897—is practically as follows: There is a sheet of the atmosphere flowing quite steadily eastward over the United States at the levels from 2 miles upward. Beneath this flows north and south, quite independently of the upper drift, a series of countercurrents which are cold and warm, respectively. The interaction of these currents sets up the anticyclonic and cyclonic whirls chiefly by dynamic action, the former causing a downward component and the latter an upward component. The cyclone receives its supply from the northwest and from the south, and thus discharges great masses of air through itself, so that the cyclonic configuration constitutes a type of persistent circulation in a vortical form of stream lines. This gyratory rotation lifts the air from one level to another, purely by its mechanical action, and thus raises the mass from the strata of lower to those of higher eastward velocity. This rapid change of eastward motion, if imparted to the air raised up, can take place only by an interchange of inertia, that which is gained by the rising air being lost by the upper eastward drift. Also the gyration of the lower strata causes deflection in the eastward drift by the composition of forces, as must be the case, since the method followed in our discussion has been to subtract the normal west-east and north-south velocities from those actually observed, the residuals being the circular cyclonic movements that are now described.

The point of view for the consideration of the theory of the general cyclone is thus considerably altered. (1) Instead of a circulation as in a canal, northward above and southward below, we find that the interchanging motion is largely confined to the lower strata, by means of currents not flowing above one another, but on the same level. (2) Instead of the momentum m (v_o — v) being determined by the difference between the eastward flow at different levels of the same latitude, we prefer the statement that cyclonic gyrations are produced by the counter flow of independent streams, and that the rapid eastward drift is retarded by mechanical inflows, from above toward the base of the anticyclone, and from below through the stream lines of the cyclone into the eastward drift. The energy upon which cyclones and anticyclones depend for their activity is to be traced to a different source from that generally assigned to it by meteorologists. The common theory is that the cyclone is due to some form of vertical convection, caused by overheating a local region, and by the latent heat produced in precipitation. Our theory would more naturally depend upon horizontal convection, by means of which temperature gradients thousands of miles in extent produce comparatively shallow streams, which flow from the north and from the south, and sustain them for considerable intervals of time. The upward and the downward discharges, together with the rotary components which make the sinuous flow of the air in the upper levels, practically tie together the upper and the lower strata, retard the eastward drift in the higher strata, and accelerate the eastward motion in the lower. This effect is readily perceived in the eastward propagation of high and low pressure areas over the United States, which is the basis of our system of forecasting and renders it possible.

It is by no means to be concluded that by suggesting this modification of the Ferrel theory, any intention exists of not recognizing fully the fact that it remains substantially correct in some of its features. There exists the eastward drift throughout the middle latitudes and the westward drift in lower levels of the tropical zone. But there is yet another reservation to be introduced. The heating of the tropical belt raises the isobars adjacent to the equator so that they slope toward the poles, and to such an extent that they almost exactly counterbalance the deflective force $2nv \cos \theta$, which is directed southward. It may properly be assumed from this that in the upper strata the directions of the isobars, the isotherms, and the stream lines of the wind motion are very nearly parallel to each other, if not coincident. The friction is evidently small, judging from theoretical conditions, and from the results of the observations, or else this could not be the case.

There is another important deduction to be drawn from this discussion regarding the flow of currents from the Tropics toward the poles in the lower strata. According to the Ferrel theory, the overheating of the Tropics is relieved by the upward expansion and overflow, but in accordance with the present view the tropical congestion is relieved by irregular streams which flow outward from the lower levels. This being the case, the poleward gradients in the upper levels are called upon to sustain much less pressure from the deflection, and evidently the tendency to excessive eastward velocities is much diminished, just because the equatorial lift of the strata can not be so great, since the expansion upward, as stated, leaks off sidewise in the lower levels. The eastward drift does not therefore increase to excessive values for these two reasons: (1) The tropical strata are not elevated up to the theoretical amount because of the escape of the currents poleward not very far from the surface of the ground; (2) the eastward drift is diminished by the operation of the vertical discharges between the lower and the higher levels produced by the purely mechanical vortex motion in the cyclones and the anticyclones.

The evidence before us is to the effect that the heating of the atmosphere is generally confined to a layer less than 5,000 meters, or 3 miles, thick. It is not intended to allude now to

[1] MONTHLY WEATHER REVIEW, March 1902, Vol. XXX, p. 117.

the annual range in temperature with the sun's change in latitude, but rather to the shorter periods of only a few days length which contribute to the impulse of streams from the south. There are several reasons which lead to this conclusion: (1) The trend of the preceding argument has been to show that the readjustments of disturbed temperature equilibrium take place in the lower layers of the atmosphere by means of rather spasmodic impulses, controlled partly by the temperature energy in the tropic and the polar regions, partly by the distribution of land and ocean temperatures, and by the relative radiation which takes place from them in the winter and summer season, respectively. (2) Half of the mass of the atmosphere is contained below the 5,000-meter level, and this is the layer within which the greater part of the aqueous vapor is also collected, since the vapor contents of the higher levels is in the form of fine ice crystals, which drift eastward, encircling the earth, and perhaps seldom finding their way to the ground. The fact that the dust of the Krakatoa volcano was thus carried about the earth for two or three years shows that the upper current has a history of its own, to a considerable extent independent of the 3-mile layer nearest the earth. Now, the important part which the aqueous vapor plays in the absorption of heat is well understood, and it depends upon the very high latent heat of water, which is 606.5 calories per kilogram at 0° C. The evaporation and condensation of water in precipitation is certainly confined to the lower stratum, and hence it is in harmony with this view to limit the effective heating of the air by the sun to the lowest 3 miles. (3) The diurnal variation of the temperature at the surface of the ground takes on a wide range. The temperature is above the normal in low areas, in the summer season, and in the middle of the day; it is below the normal in high areas, especially in the case of cold waves in the winter, and in the night-time. The range at the ground generally amounts to 10° or 20° F., but diminishes upward with the height and disappears at the 5,000-foot level, or even considerably below that height. This is shown very clearly in the study of the changes in the vertical temperatures, as explored by means of balloon ascensions, where the 5,000-foot level marks the convergence of the lines which represent the gradients in the forenoon and afternoon. The range in the United States is usually greater than in Europe at the ground, owing to the more pronounced nature of the cold and warm waves that move eastward over that region, but the evidence is that the diurnal lines converge at 2 or 3 miles above the ground. (4) The fact that the great eastward drift of the upper levels is underrun by a series of comparatively thin currents, which move about in every possible direction, shows that the disturbance of equilibrium is local and confined to a shallow skin near the ground, the most rapid currents belonging to the cumulus and strato-cumulus levels, which also implies that the upper regions of the atmosphere are much less affected than the lower. (5) The same conclusion is indicated very clearly by the seasonal change in the drift of the high areas over the northwestern portions of the United States, from the northwest in winter and from the southwest in summer, in conformity with the location of the permanent high areas in winter over the continent and in summer over the ocean.

From these considerations it seems evident that the upper atmosphere is but slightly disturbed in its temperature equilibrium by the effects of the solar radiation, but the solar rays pass through it with comparatively little absorption, while the larger percentage of the heat retained in the lower strata, is due to a change of the wave length. This conclusion is very important for two reasons: (1) It shows why the general circulation of the atmosphere prescribed by the Ferrel-Oberbeck theory does not seem to be confirmed by the observations. (2) It also indicates where the energy comes from which is finally expended in the generation of cyclonic circulations and in the retardation of the eastward drift by the agency of inertia rather than by friction; for if the total amount of energy falling upon the Tropics does not expend itself in an upper poleward current, because the higher strata retain a temperature of equilibrium almost undisturbed, then this energy must give rise to a series of comparatively small currents moving poleward in the lower strata—a fact which is abundantly confirmed by the observations. Also, if the friction of the upper atmosphere upon itself is very slight, then there will be but little retardation to an excessive eastward drift, tending under a steady force to have a constant acceleration. The only other available agency which will produce the same effect is the intrusion into the higher strata from the lower, or vice versa, of air moving eastward with a different velocity, which must suddenly be subject to acceleration. The discharge of the product passing through cyclonic circulations is perfectly fitted to perform this office. Hence, the theory here expounded consists of two parts as regards the eastward drift: (1) The upper poleward gradients are not built up to the amounts supposed by Ferrel, because of the lateral escape poleward of currents from the tropical belt; (2) The agency of friction as a retarder is replaced by the interchange of inertia derived from a compound circulation, the sources of the separate parts having different and independent causes. It has been important to thus carefully clear the ground for the theory of local cyclones, which will be advanced to take the place of the type proposed by Professor Ferrel on the one hand, or of that advocated by the German school on the other hand. These two theories are not in harmony with each other, and neither of them seems to be in agreement with the observations. It is very evident that the six assumptions which have been made in order to pass from the general equations of motion, 200, to the working system employed by Ferrel, 397a, must be carefully revised before we can expect to put this branch of meteorology upon a correct working basis. In particular it is not suitable to omit the variations of temperature in longitude, because in so doing the turbulence of the lower strata and the alternate streams which are implied in this variation profoundly modify the general and the local circulation. It is also necessary to correct the statement regarding the friction as the special agency of retarding accelerated flows and substitute, or rather add thereto, the inertia of currents which are rapidly changing their velocities. The conflict of turbulent countercurrents, especially at a short distance above the ground, must be rigorously considered in studying the resultant effects. Likewise the direct application of the law of conservation of areas passed over by the rotating radius vector can not apply immediately to the lower strata, though it may be much more nearly correct above the 3-mile level.

MODIFICATION OF THE CANAL THEORY.

In consequence of these considerations it seems necessary to modify the canal theory to such an extent as to be practically equivalent to an abandonment of it. If this is done it is important to trace out a chain of circumstances which will give a more correct account of the general and the local circulation of the atmosphere. The canal theory is very artificial, depending as it does upon a simple laboratory experiment, in connection with an obvious analysis of the general equations of motion. If this theory is to be preserved, then we must be assured that the atmosphere does in fact traverse the circuits prescribed, for it has been commonly assumed to conform with the facts of observation. As has been shown, observation does not bear out the requirements of the theory, and I shall, therefore, attempt to trace out in a descriptive way the circulation as it is developed over the North American Continent. The reduction of this kinematic picture to the corresponding mathematical form of dynamics is a task of very great difficulty, as may readily be inferred.

We may conceive the tropical strata to be elevated by thermal expansion relative to the polar regions, so that there is a certain average gradient slope and corresponding west-east velocity which is in equilibrium with it in accordance with the usual equations. If the canal theory of circulation is in operation we have poleward gradients in the upper strata, and equatorward gradients in the lower strata. If, instead of maintaining this circulation, there is an escape of currents from the Tropics in the lower strata in a poleward direction, then the gradients of the canal theory diminish and become much more moderate in consequence of this release of tension. Every such leakage current from the Tropics causes a break or fault in the gradient, and this must be attended by a corresponding deflection of the eastward current, through the operation of the deflecting force at right angles to it, due to the earth's rotation. Referring to the scheme of self-regulation of the circulation by the rise and fall of the gradients, fig. 18,

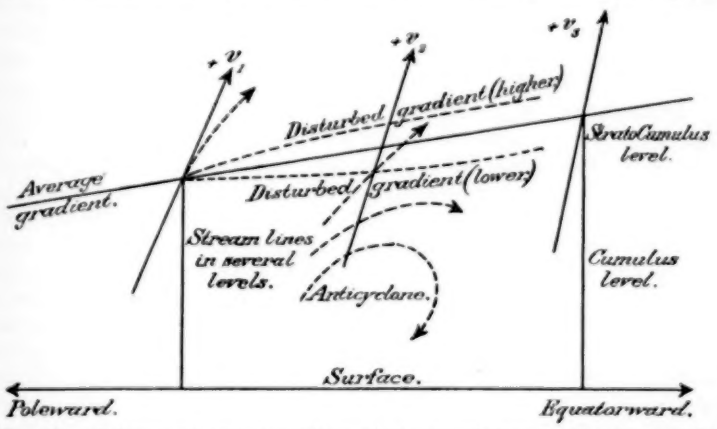

FIG. 18.—Scheme of self-regulation of the circulation by the rise and fall of the gradient.

we may consider the average gradient in the strato-cumulus level. When in its mean position, as determined by the whole set of natural circumstances which produce it, the isobars and the wind with a given direction and velocity are all practically in coincidence. The velocity is just enough to maintain the slope of pressure as measured by the gradient. If the thermal expansion of the Tropics increases, the gradient slope is elevated, the eastward velocity is increased, and this acceleration will continue to advance till an excess of energy secures for itself a way of escape. This increase of velocity is probably checked as follows:

From the Tropics in the lower levels, that is in the cumulus and strato-cumulus strata, a stream of air breaks away from the canal circuit, and pushes northward in some irregular course. This evidently causes a break in the gradient surfaces, such as is indicated, for example, by the dotted lines of fig. 18, and the slope of pressure which held the eastward drift in its position gives way. The action of the deflecting force due to the earth's rotation bends the current southward as is indicated, and there is thus made the beginning of an anticyclonic local movement. In the lowest levels, from cumulus down to the surface, the break in the average gradients may be so pronounced as to offer but little check to a complete anticyclonic gyration, such as appears at the surface of the earth. This deflection of direction causes a whirl and absorption of energy in the strata affected through the local interchange of inertia, and slows up the eastward drift by the vortex action which is produced with a downward component. The alternate rise and fall of the gradients, and the attendant anticyclonic gyrations, mark the successive efforts at self-regulation which the atmosphere as a thermal engine imposes upon itself. These continental pulsations are shown on the weather maps as the procession of high and low pressure areas which traverse the middle latitudes. In consequence of the superior velocity of eastward motion in the strato-cumulus level, this region is the first to feel the decline in gradient strength, due to the tendency of a stream to escape from the Tropics, as from the Gulf of Mexico over the United States. It thus happens that the anticyclone is not only larger in area, but it also generally precedes the cyclone in its formation. There are numerous instances in which the anticyclone overspreads the United States, while there is no important cyclone in connection with it, except possibly some depression or irregular action along the edges of the high area. Usually, however, incipient cyclones increase in intensity from these small beginnings, and they may even seem to drink up and exhaust the air which is flowing in anticyclonic circulation. This is the reason why I have heretofore described the anticyclone as preceding the cyclone in efficiency, and have thus reversed the order of action as taught by Professor Ferrel in his well-known theory.

The warm stream from the south is deterred from mingling with the cold anticyclonic air by the difference of its temperature, and the result is that the eastern side of the anticyclone, which flows southward, and the warm escape current from the south, flowing northward, compose two counter currents. These two currents together generate the cyclone, which is a vortex with an ascending central velocity. The gyration is produced by the action of the two independent streams acting like a couple, since they each depend upon separate gradient systems for their own mechanical pressures. It is not a gyration due to frictional impact, but rather to the steady pressure on the arms of a couple, since the streams are driven by independent gradients, and are held apart by having different temperatures in the two separate currents. The air is thus raised from the lower to the higher strata in great masses, by circulating through the configuration of the cyclone, and this, too, produces a retardation of the eastward drift by an immediate interchange in the inertia, since there is a quick mingling of air having different directions and velocities. Examples of this action can be seen by studying the Charts 20 to 35, inclusive, of the International Cloud Report. Furthermore, the motions of the atmosphere result in placing strata of air having different temperatures together, side by side, so that the surface isotherms are directed from the southwest to the northeast, and in consequence the northwest portions of a cyclone are cold and the southeast portions are warm. This does not conform to the requirements of either the Ferrel or the German theories, which demand a warm local center for the generation of cyclones. Yet if two such masses of air lay alongside while they are of different temperatures, an interchange of heat contents will take place locally between them, and thus the streams will interflow in such a way as to strengthen the cyclonic gyration. This will be accompanied by distinct stratification of the air currents in the local cyclones, such as is observed in the kite and balloon ascensions, since the air of different temperatures is drawn out into thin ribbons having large discontinuous surfaces, which are favorable to the interchange of heat. It is frequently found that a great anticyclonic area as it approaches the ocean, although attended by no cyclone, will yet suddenly cause a violent whirl to form on its edge by the mere action of these adjacent masses of different temperatures. Such local storms are sometimes formed on the Atlantic coast during a single night, and they may cause vortices with hurricane velocities on the coast. The line of junction of these warm and cold currents, along the southern and southeastern parts of the low area, is the locus of the formation of the majority of the tornadoes of the United States, the counter flow setting up the gyration, which is converted into a genuine columnar vortex, through which the heated air of the lower strata escapes into the colder strata of the higher levels. The hurricanes of the West Indies similarly form along the places of the counter flow between the Atlantic high area and the southeast trade winds when at

their extreme northern limit, as in August to October. The vortex then travels westward and skirts around the periphery of the high area until it is absorbed finally in the eastward drift of the higher latitudes. Such dynamic intermingling of the general and the local circulation is, therefore, not only in accordance with observations, but it is a suitable substitute for the defective canal theory of the general circulation, and also for the untenable theory of the local cyclones and anticyclones, supposed to be dependent upon the central heat produced by condensation of the aqueous vapor of precipitation. This view is attended, on the other hand, by the following disadvantage: That while the canal theory and the warm center cyclone theory lend themselves readily to mathematical treatment and to analytic solutions of considerable elegance, we are obliged to substitute for them an irregular system of stream lines in the lower strata, not at all readily put into mathematical forms. This turbulent circulation, with its self-adjusting government of the eastward flow, its interaction between the general and the local vortices, its numerous subordinate phenomena, such as tornadoes, hurricanes, and cyclones, is easy to comprehend, but hard to analyze mathematically into the exact dynamic forces of equilibrium. It is possible to construct several special typical configurations for each district of the earth, as was done for the United States in Charts 20–35, inclusive, of the International Cloud Report, and then draw the stream lines, with their velocities, in order to prepare for the computation of the dynamic forces involved. This is the true meteorological problem of the future.

THE STRUCTURE OF THE ANTICYCLONE.

We will now examine a little more closely the structure of the anticyclone and the cyclone as given by observations for the sake of the analytical problems presented by their configuration. It has been claimed by meteorologists that there is a southward component in the middle strata of the north temperate zone toward the high pressure belt, but a northward component in the upper strata and another northward component near the surface, as is indicated on fig. 13, Paper IV[2]. The observations of 1896–97 do not, however, give such a distribution of the mean components, for they show that there is a very small average drift northward in all strata, increasing slightly with the height above the surface. That is to say, the atmosphere in the eastern and central United States drifts northward a very little and thus supplies part of the air that descends into the anticyclones through the upper strata. We have indicated how the leakage in the lower strata from the Tropics in part replaces the air which descends in the anticyclonic areas, and it is assumed that the small residual northward drift complements the amount that is required to fill the anticyclonic areas. The downward vortex, therefore, draws in a portion of the air passing through it from the upper strata, as a consequence of the gyration induced through the countercurrent action, and therefore the feeble northward component of the circulation of the higher strata seeks the surface practically in the middle latitudes, before arriving at the polar zone, through the mechanism of the local vortices. Hence, it follows that there is little cause for the formation of a general anticyclone close to the pole itself, which Ferrel assumed to exist; the result of Kimball's discussion in the MONTHLY WEATHER REVIEW, September, 1901, goes to show that this movement only feebly exists, and is in conformity with this exposition of the general circulation. Therefore, the air that descends in a local anticyclone comes from two sources, the leakage currents from the Tropics in the lower and middle strata and the feeble northward drift in all strata, especially the higher.

There is one feature of the anticyclonic vortex which may be mentioned, though it belongs more properly to an analytic treatment of that circulation. The anticyclonic components of fig. 6, Paper III[3], show that we are not dealing with a pure form of vortex. The two possible laws are typically the parabolic $\frac{v}{\varpi}$ = constant, and the hyperbolic $v\varpi$ = constant.

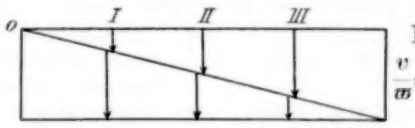

FIG. 19.—Mixed system of hyperbolic and parabolic components.

According to the parabolic law $\frac{v}{\varpi}$ = constant, the circulation causes simply a depression in the center of the gyrating fluid; according to the hyperbolic law $v\varpi$ = constant, there is a vertical component of circulation as in ordinary vortices. In the observed anticyclonic components the velocities v are about equal to each other on the I, II, III, circles, and it seems to me that this can only happen if there is a mixture of these two laws of motion. Thus we may divide the observed components v_{I}, v_{II}, v_{III}, into two parts by a diagonal as shown on fig. 19. The upper components represent the parabolic, and the lower the hyperbolic portions. This is physically necessary for the following reason. The anticyclone is formed by large currents of air moving in more or less independent streams on its outer portions, while only curling offshoots reach its central parts; this would produce the pure parabolic components only. But, through imperfect pressure gradients there is also near the center a true downward component of circulation, and this can be supplied only by the action of hyperbolic components, that is to say, of a simple vortex motion. Hence, the general anticlockwise movement of the anticyclone, strongest on the outer circles, has accompanying it a true downward or vortex component which lengthens the components u in the central portions. If this is correct, one sees an additional reason for holding that Ferrel's explanation of the anticyclone is impracticable, and also that the reversing of the cyclone to make an anticyclone, as proposed by Oberbeck and Pockels is not warranted. We need very accurate observations to settle so difficult a point of pure theory, but I can not at present see any other satisfactory explanation of the gyratory components derived from the Weather Bureau observations.

STRUCTURE OF THE CYCLONE.

In Table 18 we give the results of cloud observations in the United States.

In the following example the relations which should exist in a pure vortex are deduced for comparison with the data given under low areas in Table 18.

Taking the inward radial velocity $u = -1.25$, at the distance 1,250 kilometers, assuming $\lambda = .000100$ for $\theta = 46^\circ 17'$, and $c = .000002$, also $k = .000050$, their introduction into the several formulæ gives the values found in Table 19.

An account will be given of the derivation of the formulæ in Paper VI.

It is seen that the rotational velocity v is about the same as that given by the observations up to the circle whose radius is 150 km = 93 miles from the center, as seen under v_2 of Table 18. The values of the radial velocity agree fairly well, if we admit that the observations may be somewhat imperfect for this component up to the region of the inner circle I, whose radius is 250 km. There the component u is much larger than expected in the upper strata, and this indicates some opposition to the free development of the vortex near the core. It is presumed that this implies a struggle to intrude into the rapid eastward drift, accompanied by a broadening of the vor-

[2] MONTHLY WEATHER REVIEW, April, 1902, Vol. XXX, p. 166.

[3] MONTHLY WEATHER REVIEW, March, 1902, Vol. XXX, p. 117.

TABLE 18.—*Anticyclonic and cyclonic velocities at each 1,000-meter level. (Copy of Table 126 International Cloud Report.)*

Cloud forms.	Height in meters.	High areas. I u_2	I v_2	II u_2	II v_2	III u_2	III v_2	Low areas. I u_2	I v_2	II u_2	II v_2	III u_2	III v_2	Velocities in the general cyclone. u_1	v_1
Ci. and Ci. St.	10000	—3.5	—4.0	+ 4.5	—5.5	+2.5	— 3.0	—6.5	+ 3.0	—1.0	+ 3.5	0.0	—3.0	—2.8	+35.4
	9000	—3.5	—5.0	+ 4.5	—5.0	+2.5	— 8.0	—3.0	+ 8.0	—3.0	+11.0	—1.5	—1.0	—2.6	+35.0
Ci. Cu.	8000	—3.0	—6.0	+ 3.5	—4.5	+2.0	— 9.0	—2.5	+11.0	—5.5	+13.5	—2.0	+1.0	—2.4	+34.6
	7000	—1.5	—6.5	0.0	—4.5	—1.5	— 8.0	—6.5	+13.5	—5.0	+15.0	—2.0	+2.0	—2.2	+30.0
A. St.	6000	0.0	—7.0	— 2.5	—4.5	—4.0	— 7.5	—9.0	+15.0	—2.0	+15.5	—0.5	+3.0	—2.0	+25.0
	5000	0.0	—7.5	+ 2.5	—6.0	—2.5	— 8.0	—9.0	+17.0	0.0	+15.5	+1.5	+5.0	—1.8	+23.6
A. Cu	4000	0.0	—7.5	+ 8.5	—8.0	0.0	—10.0	—7.5	+20.0	0.0	+14.5	+2.5	+7.0	—1.6	+22.6
	3000	0.0	—7.0	+10.0	—9.5	+2.0	—12.0	—3.5	+23.0	0.0	+13.0	+2.0	+7.5	—1.3	+21.0
S. Cu.	2000	+1.0	—6.0	+ 7.5	—9.5	+2.0	—11.0	—1.0	+20.0	0.0	+11.0	0.0	+5.0	—1.0	+14.0
Cu. and St.	1000	+3.5	—4.5	+ 5.0	—7.5	+1.5	— 7.0	0.0	+ 8.0	—1.5	+ 8.0	—1.5	+4.0	—0.8	+ 6.4
Wind.	0000	+4.0	—2.5	+ 2.5	—4.0	+1.0	0.0	0.0	+ 6.0	—3.5	+ 3.0	—2.0	+3.0	—0.5	+ 1.3
Means of the velocities, u_2, v_2		—0.3	—5.8	+ 4.2	—6.2	+0.5	— 7.6	—4.4	+13.1	—2.0	+11.2	—0.3	+3.8		
Radius, ϖ			1		3		5		1		3		5		
Product, ϖv_2			—5.8		—18.6		—38.0		+13.1		+33.6		+19.0		

$+u_2$ = outward on radius.
$+v_2$ = anticlockwise about center.

I. $\varpi_I = 250,000$.
II. $\varpi_{II} = 750,000$.
III. $\varpi_{III} = 1,250,000$.

$+u_1$ = south.
$+v_1$ = east.

TABLE 19.—*Application of the formulæ for a cyclone. (Copy of Table 127, International Cloud Report.)*

CONSTANTS AND FORMULÆ.

$\theta = 46° 17'$ $\quad \lambda = 2n \cos\theta = .000100$

$u = -1.25$ $\quad c = -\frac{2u}{\varpi} = .000002$ $\quad \frac{\lambda}{k-c}\frac{c}{2} = .000002$

$\varpi = 1,250,000$ meters $\quad k = .000050$

$\psi = -\frac{c}{2}\varpi^2 z.$ $\quad u = -\frac{c}{2}\varpi.$ $\quad v = +\frac{\lambda}{k-c}\frac{c}{2}\varpi z.$ $\quad w = +cz.$ $\quad \cot i = \frac{\lambda}{k-c}z.$

DERIVED DISTANCES, VELOCITIES, CHECKS, AND INCLINATIONS.

ϖ meters.	miles.	z	ϖz	u	v	w	ϖv	$\varpi w = -2uz$	cot i	i °	G mm.
1250000	777	1.00	1250000	—1.25	2.50	.0000020	3125000	2.5	2.00	26.6	0.34
1000000	621	1.56	1560000	—1.0	3.125	31	3125000	3.1	3.12	17.6	0.40
750000	466	2.78	2085000	—0.8	4.17	56	3125000	4.2	5.56	10.2	0.55
500000	311	6.25	3125000	—0.5	6.25	125	3125000	6.3	12.50	4.6	0.78
250000	155	25.00	6250000	—0.25	12.50	500	3125000	12.5	50.00	1.2	2.03
200000	124	39.06	7812000	—0.20	15.61	781	3125000	15.6	78.12	0.7	3.00
150000	93	69.40	10412000	—0.15	20.82	1388	8125000	20.8	138.80	0.4	5.37
100000	62	156.30	15630000	—0.10	31.26	3126	3125000	31.3	312.60	0.2	13.90
50000	31	625.00	31250000	—0.05	62.50	12500	3125000	62.5			
40000	25	977.00	39080000	—0.04	78.16	19540	3125000	78.2			
30000	19	1736.00	52080000	—0.03	104.16	34720	3125000	104.2			
20000	12	3906.00	78120000	—0.02	156.24	78120	3125000	156.2			
10000	6	15625.00	156250000	—0.005	312.50	.0312500	3125000	312.5			

tex tube through the resistance, v being smaller than it should be and u greater, making the angle of the inclination i much greater than it ought to be in pure vortex motion. As the computation of the vortex goes to the height of 10 miles, far beyond the altitude to which the ordinary cyclonic motion penetrates, this being only 3 or 4 miles in the moderate movements of the air, it is seen that v should theoretically attain enormous velocities very near the center. The difference between these and such as are actually observed may be regarded as measuring the energy expended in breaking up the cyclone in the higher levels, which can be balanced only by retarding the movements of the general cyclone. The vertical velocity w is extraordinarily small from the bottom to the top, and in a measure justifies the method of discussing the motions of the air in the cyclone as a case of horizontal movement. It is impossible theoretically, however, that such a cyclonic motion without a vertical component should exist at all. The fact is that a slow vertical movement is acting over the very large

area covered by the cyclone, and is sufficient to carry off all the air which flows into it through a thin disk at the outside in horizontal directions toward the center. The checks ϖv and $\varpi w = -2uz$ hold throughout the cyclone, thus proving that our data are at least approximately correct. The angle i, between the tangential direction and the current, theoretically becomes very small within 300 miles of the center. It was shown by the results of the observations that the movement at the cumulus level is much more rounded than in the lower strata, the difference being caused by the retardation of the air operating upon the surface irregularities of the ground. A congested or irregular inflow near the center will similarly increase the angle i, since the component u is increased and v diminished by it. The observations given on the weather maps do not record the conditions within 60 miles of the center with any definiteness. In hurricanes the core is about 30 miles broad and its boundary is quite sharp, which shows that the component v is highly developed, while u is small. But the hurricane also penetrates to much greater altitudes, as already mentioned. Finally, the gradient shows that there is a slow change near the outer limit, but that it increases very rapidly on approaching close to the center.

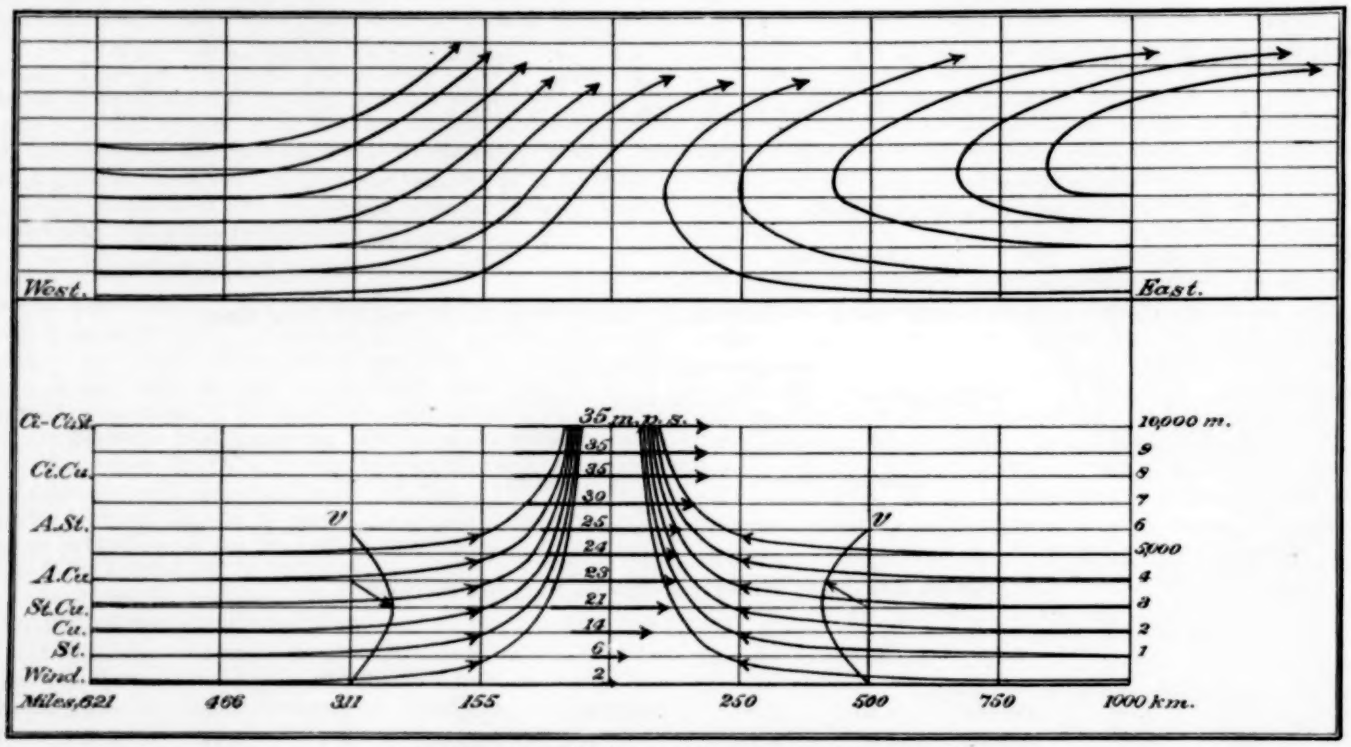

FIG. 20.—General scheme of the structure of cyclones.

THE SPECIAL FEATURES OF THE CIRCULATION.

The special features of the circulation indicated on fig. 20, which may be mentioned are as follows: (1) It is evident that this scheme avoids entirely the primary difficulties attending the Ferrel and also the German types of circulation. Each of these divided the cyclone into two parts having special properties. Ferrel divided his cyclone at a vanishing rotational velocity, $v = 0$, which involved a circulation in opposite directions on either side of it; the German type consists of two parts, separated by a discontinuous movement at the circle of the maximum velocity for v. The pure vortex, on the other hand, has only one law to deal with, and that, too, the simplest of all, in accordance with which the motion is generated. (2) Neither of the other types provides for a true calm region at the center of the cyclone, commonly observed in hurricanes as the eye of the storm. Ferrel's formula 402*b* shows that v increases from the circle $R = 0.707$ to the very center; the formulæ 450 and 471 show that the velocity v decreases gradually from the circle bounding the inner region toward the center, but does not vanish till reaching it. The construction here proposed indicates that since v is a function of the height z as well as of the radial distance ϖ, the air in streaming toward the center is gradually lifted above the ground by purely dynamic action and leaves a core without gyratory circulation. (3) The approach of a moving particle to the axis of the cyclone is attended by an increase of the velocity of rotation, which accelerates rapidly as it passes into the upper strata. There it accomplishes the work of deflecting the eastward drift, and it expends some of its energy in that way. The result of this opposition to free motion is to spread out the top of the vortex, reduce its gyratory velocity, and change the relations of v_2 and u_2. In the undisturbed gyratory motion the component v_2 becomes very great in comparison with u_2, and u_2 is always a small quantity. An inspection of Table 18 shows, however, that in the strata, between 5,000 and 10,000 meters the radial velocity u_2 is relatively large, and the angle of the inclination instead of being nearly 0° is from 25° to 35° on the inner circle II. This means that the original coefficient upon which the dimensions of the cyclone depend, namely, $c = -\frac{2u}{\varpi}$, does not remain a constant, but increases from the boundary toward the axis of the gyration. Thus we obtain,

$$c_{\mathrm{I}} = .0000352 = \frac{0.6}{1250000}$$

$$c_{\mathrm{II}} = .0000053 = \frac{4.0}{750000}$$

$$c_{\mathrm{III}} = .0000005 = \frac{8.8}{250000}$$

This involves an expenditure of energy in the struggle attendant upon intruding into the swiftly moving upper stratum. Furthermore, as was previously pointed out, Ferrel's theory of the slowing down of the excessive eastward velocities which would arise from the pure vortex law of the

TABLE 20.—*Dimensions and velocities in the waterspout off Cottage City, Vineyard Sound, Mass., August 19, 1896.* (*Copy of Table 128 International Cloud Report.*)

Working formulæ: $v^2=2gz$; $u=\frac{v}{z}$; $w=\frac{2r}{\varpi}$; $\varpi v=\text{Const.}$; $2zu=\varpi w$; $\frac{c}{z}=\frac{4g}{v\varpi}$.

Dimensions in meters.			Velocities in meters per second.				Dimensions in feet.			Velocity in miles per hour.		
h	z	ϖ	u	v	w	$2zu=\varpi w$	h	z	ϖ	u	v	w
1280	0	∞	—	0	0	0	4200	0	∞	—	0	0
1278	2	518.4	3.13	6.26	0.02	12.53	4193	7	1701	7.0	14.1	0.04
1189	91	76.9	0.46	42.24	1.10	84.49	3901	299	253	1.0	94.4	2.5
1097	183	60.8	0.29	53.39	1.76	106.79	3599	601	200	0.6	119.5	3.9
1006	274	44.3	0.27	73.31	3.31	146.61	3301	899	145	0.6	164.	7.4
914	366	38.3	0.23	84.72	4.42	169.45	2999	1201	125	0.5	189.	9.9
731	549	31.3	0.19	103.77	6.63	207.53	2398	1802	102	0.4	233.	14.9
549	731	27.1	0.16	119.73	8.83	239.47	1802	2308	89	0.4	268.	19.8
457	823	25.5	0.15	127.04	9.94	254.10	1409	2701	84	0.3	284.	22.2
366	914	24.3	0.15	133.89	11.04	267.78	1201	2999	79	0.3	300.	24.7
183	1097	22.1	0.13	146.68	13.25	293.36	601	3599	72	0.3	328.	29.6
146	1134	21.8	0.13	149.13	13.70	298.26	479	3721	72	0.3	333.	29.7
0	1280	20.5	0.13	158.44	15.46	316.89	0	4200	67	0.3	354.	34.6

$c=0.01208$

conservation of areas applied to the general cyclone, is that friction is largely concerned with the operation. It seems, however, that a much more efficient cause of retardation is the interaction between these two types of motion, namely, the linear and the rotary, by which the lower strata thrust themselves into the higher. The effect is to enlarge the size of the vortex tube at the top by the resistance, deflect the eastward drift into sinuous curves, slow down the eastward velocity, and thus restrain the general cyclonic movement from excessive values. (4) The resultant of these component forces and velocities is to produce a circulation along the parallels of latitude which may be represented by the upper part of fig. 20. The upper clouds of the cirrus region precede the cyclone proper as forerunners of this type of circulation; the lower clouds follow in succession, till precipitation is produced at the elevation of 1,000 to 3,000 meters; in very rapid circulations the eye of the storm is fully developed; the clearing up is more abrupt on the westward than on the eastward side of the cyclone. (5) The progressive movement of storms is partly an effect of the cyclone covering an area of sufficient extent to be in different latitudes, so that variations in cos θ amount to something. But other circumstances are more important. By Table 33, Section IV, International Cloud Report, it is seen that the northward components for the group of areas which are covered by the currents of air from the south are greater than those from the north. That is to say, the movement in the streams from the Tropics is more rapid than that from the polar regions, and the result is to roll up the eastward side of the cyclone to the north more than the westward to the south. The cyclone tends to rotate along the front of a high area toward the north. At the same time its top is fastened by means of the circulation into the eastward drift at 4,000 meters elevation, and these two components make the storm move northeastward in the central and eastern portions of the United States. If the general cyclone has other directions, as when hurricanes form in the Caribbean Sea, the same principles hold, and the storm there first moves westward, then northward and northeastward, because the general circulation is controlled in that region by the anticyclone in the southern portions of the north Atlantic Ocean. (6) It has been shown that the currents which feed the cyclone have different velocities at different altitudes, being greatest from 2,000 to 5,000 meters above the ground. Each stratum forms a stream for itself conforming to the general law, but modifies its dimensions according to the constants pertaining to the special locality. Since these different strata have thus distinct local movements, especially considering the variable temperatures and densities of the currents from the north and south, respectively, it follows that the conditions are favorable for the formation of turbulent minor circulations of all kinds. The movement of the air is therefore partly congested, and partly runs in free whirls, the difference of equilibrium in temperature being gradually reduced to the proper normal value for the latitude and altitude by this forced intermingling of the subordinate parts of the cyclone. This process of restoring to an equilibrium the temperature of masses, bearing with them that of the region from which they came, is generally completed by the time the 5,000-meter level is reached, judging from the records of the balloon observations. In summer, when the eastward drift is relatively slow, the pure vertical convective ascension may extend up to 10,000 meters. This is much more likely to happen on the eastward than on the westward side of a cyclone, because the vortex components throw back the eastward movement upon itself, and thus make the strata more stagnant in vertical directions. It has also been found practically very difficult to make the kites fly on the east of the low center, the best ascensions being made on the southerly and westerly quadrants. (7) The entire problem of analyzing the movements of the air in their details is so exceedingly complicated that only slow improvements in dynamic meteorology can be expected. A clearer idea of the fundamental conditions may, however, enable us to advance more rapidly than is now expected. It will be a very important gain if meteorology can free itself from some of the theories which have so long prevailed, but which now are seen to be quite untenable, and have seriously retarded its advancement.

THE VELOCITIES IN TORNADOES.

The motions in tornadoes are similar to those in cyclones,

yet the tube is not only inverted in position, but the stream lines occupy only the central portions, and the lines of ψ become tangent to the plane whose height is H_0 at certain distances from the center. The fundamental equations for the tornado are 303–308. $\psi = +\frac{c}{2} m^2 z$ holds for the tornado with vertical axis positive downward, and the single bounding plane at the distance H_0 above the ground. $\psi = -\frac{c}{2} m^2 z$ is the equation for the cyclone with the vertical axis positive upward. A multitude of minor relations and comparisons can be drawn from the two sets of equations 303–308 and 488–490. If the lower part of fig. 20 be looked at as if the horizontal axis were the vertical, we have a picture of the tornado tube. The diagram is not good because not drawn to scale, but the idea is easily understood. Hence, one law serves for all types of local storms, cyclones, hurricanes, and tornadoes, which thus theoretically differ from each other only in their dimensions and in the details by which they are formed. Cyclones are generated chiefly by horizontal convection currents; hurricanes have a stronger vertical convection current and also horizontal convection currents; tornadoes arise chiefly from vertical convection, assisted by some horizontal currents which counter flow in the cumulus level.

It may be remarked that the stream lines indicated by Ferrel, page 300, Recent Advances, are conjectural only, and do not conform to the theory of stream lines in a vertical vortex tube, nor to observation, which shows that the air is quiet close up to the boundary of the tornado tube.

THE WATERSPOUT OFF COTTAGE CITY, MASS., AUGUST 19, 1896.

The result of the computation on this interesting waterspout is added, and it shows the dimensions and velocities in metric and English measures which were derived from the observed distances and the formulæ. The most important feature is the value of the vertical velocity of 35 miles per hour at the sea level. See Table 20.

ANNALS OF THE ASTROPHYSICAL OBSERVATORY OF THE SMITHSONIAN INSTITUTION, VOLUME I.[1]

By S. P. LANGLEY, Smithsonian Institution, dated April 29, 1902.

The work upon the infra-red solar spectrum, described in this volume, is the latest outcome of investigations with the bolometer, begun with the invention of that instrument by the writer about the year 1880. In the use of the bolometer (in principle so well known now as to need no description) the practise at Allegheny during the nearly ten years that studies of the infra-red spectrum of the sun were in progress there, required at least two and preferably three observers. One made and read the settings of the spectroscope, a second read as often as he could the indications of the galvanometer, while the third recorded all the observations and operated the shutter in front of the slit of the spectroscope. In those days the galvanometer, though far less sensitive than that now employed, was rarely free from "drift," or wandering of the spot of light upon the scale and this "drift" was usually so rapid that the spot of light would cross the whole scale within a few minutes.

It had been my intention at Allegheny to replace the tedious and incomplete system of eye observations at the galvanometer by an automatic photographic recording apparatus, but the "drift" stood as a seemingly insuperable obstacle in the way. The difficulty was attacked immediately after the installation of apparatus at the Astrophysical Observatory at Washington in 1891. Without stopping to mention details, it need only be said that by persistent efforts carried on through more than ten years as described in the early chapters of the Annals, and with the aid of several devices which the reader may find there illustrated, these obstacles have been removed and it has become possible to use the galvanometer with perfect success to produce a purely automatic record, in connection with the bolometer, and with a photographic recording apparatus.[2]

As thus perfected, the procedure of mapping a portion of the spectrum is this:

A prismatic spectrum is formed by a spectroscope of the so-called "fixed arm type," in which, as the reader will recall, the ray which is in minimum deviation is given a certain fixed direction by an optical method, so that the observing instrument remains fixed also. This observing instrument is here the bolometer, whose essential part is a Wheatstone's bridge, chiefly formed of two excessively narrow and thin strips of platinum, only one of which is exposed to the radiation to be studied. On looking into the eyepiece of the bolometer, this appears like a single spider web wire of a micrometer, seen against the background of the spectrum, for instance just below the A line, whose position might be read by it on the large azimuth circle on which the bolometer is mounted. But this thread is not alone a fiducial index, for since it conveys an electric current it is also sensitive and comparable to a nerve which will recognize the heat or cold which falls on it, and not only recognize but accurately measure it by the changes set up in the current in question.

The whole forms an electrical thermometer which actually measures to very much less than the millionth of a degree.

As the bolometer strip is warmed or cooled the galvanometer mirror turns to and fro, and the spot of light which it reflects passes to and fro on its scale, which is here a photographic plate. A clockwork of extreme accuracy moves the rock salt prism so that the spectrum marches uniformly across the bolometer thread at a rate, let us say, of one minute of arc in one minute of time, while the photographic plate moves as regularly in a vertical direction at right angles to the movements of the galvanometer spot at a rate, for example, of a centimeter in one minute of time. There is thus produced a curve called a bolograph, in which ordinates accurately correspond to relative amounts of energy, and abscissæ to deviations in the prismatic spectrum. Depressions in this curve correspond to cooler lines or bands in the spectrum; the visible Fraunhofer lines, which are cool to the bolometer, appear as such deflections in the bolographs; the invisible lines, which are wholly insensible to the eye and chiefly insensible to the photographic plate, but which are recognized everywhere by the bolometer and discovered to fill the whole infra-red, are recorded also.

The first object of the principal research described in the Annals was to map out in detail the hitherto scarcely explored region of the solar spectrum between the limit of the visible, just below A at about 0.8μ and a wave length of 5.3μ, beyond which little energy reaches the earth from the sun. In the accompanying illustration, Plate I (similar to Plate XX of the Annals), two bolographs taken on different days are superposed to show the coincidence of their indications, which directly represent the solar energy in this (invisible) part of the spectrum, and beneath is a corresponding line spectrum drawn to show the region mapped in a more conventional aspect. At the left we see the comparative space occupied by the Newtonian or visible spectrum, on the scale of the average dispersion of the prism in the infra-red. Above is a curve obtained by Lamansky about thirty years ago, which gives the sum of the knowledge of the infra-red spectrum at that time, and was then justly regarded as a great triumph.

In the work of the Astrophysical Observatory over 700 lines

[1] Washington, D. C., Government Printing Office, 1900.

[2] The "drift," long the great enemy to bolometric research, has become so much reduced that often it amounts to less than a single centimeter an hour, whereas in the old days a centimeter a minute would have been regarded as relative perfection.

have been found between the *A* line at 0.76μ and a wave length of 5.3μ. Their determination required over 40,000 measures with the comparator, a careful comparison of upward of twenty bolographs, and a long subsidiary research on the dispersion of rock salt, all of which the reader may find in the Annals.

To the meteorologist, who, perhaps has little concern with the small solar absorption bands discovered, the work has nevertheless several features of distinctive interest. It will be remembered that beyond the vicinity of 1μ, where occur the bands ρ, σ, τ near the Ultima Thule of the spectrum, as defined by the elder Draper, nearly every line has been discovered by the bolometer down to and including the great band Ω. Beyond this lies a region first discovered by the writer on Mount Whitney in 1883, called the New Spectrum in Plate I, in which every inflection and line, without exception, was discovered with the bolometer. There are in the infra-red spectrum, above a wave length of 4μ, five great bands of progressively increasing magnitude, which are all known to be due to water vapor.[3] They lie, respectively, at 0.92μ, 1.1μ, 1.4μ, 1.8μ, and 2.6μ. The first of these is in the neighborhood of the bands which the elder Draper discovered upon a phosphorescent screen and called α, β, γ. The present designation of this water vapor band at 0.92μ was, I believe, given by Abney. The next four bands have been distinguished by me as Φ, Ψ, Ω, and N, the two latter being first observed at Allegheny; Ω having been, till the Mount Whitney expedition, supposed to be the limit of the solar spectrum. I have said in my writings, in substance, that all these are probably due to water vapor, but the demonstration that they are so has been given since by others.

In the region below Ω, at the particular points which I have called x_1 and x_2, the energy curve assumes the form of a high elevation near noon, but toward the afternoon melts away so that what was a summit becomes a valley. This is probably due to the absorption of water vapor with a mingling of carbon dioxide. A little lower, the great band *Y* (first observed by me at Allegheny) has been found by others to be caused by the absorption of carbon dioxide, but I will not enlarge upon the nature of these bands further.

These six regions of powerful absorption of the sun's rays by the gases of the earth's atmosphere, extend in the aggregate over a range of wave lengths three times as great as the visible spectrum, and there are still in addition extensive regions of considerable, though less complete, absorption by water vapor.

It is found that great changes occur in the amount of terrestrial absorption by water vapor in the region studied. The full extent of these changes was not recognized at the time the Annals appeared, but in Chapter VII much of interest in this connection is given. A yearly cycle of variations is described and illustrated in the Annals and is confirmed by subsequent bolographs. Later and, as yet, unpublished work, especially within the present calendar year, has added most materially to the knowledge of these changes of terrestrial absorption.

It appears that during the spring months water vapor absorption is at a minimum in Washington. In summer the absorption greatly increases, reaching its maximum in August. The air again becomes dryer apparently for a time in the autumn, after which another period of greater absorption succeeds.

My attention has lately been called to the consonance of this cycle with the results of actinometry carried on since 1883 at Montpellier, in France. The reader's attention is drawn to a plot of these results which appeared in the MONTHLY WEATHER REVIEW for April of the present year. The Montpellier observers are able to note by the aid of the Crova recording actinometer a yearly cycle of fluctuations in the amount of solar radiations received at the earth's surface. I have myself used the excellent Crova actinometer with good results in the determination of solar radiation. At the same time, the bolographic work I have referred to shows that the fluctuations that the French observers have noted are caused in all probability by a varying absorption of the earth's atmosphere attending changes in the amount of water vapor which it contains. Recent bolographic observations (made here in March, 1902), have shown that fluctuations in the amount of solar radiation received at the earth's surface amounting to as much as 7 per cent of the whole, may be occasioned merely by a difference in water vapor absorption between two days in the same week that appear to the eye to be equally clear. Far in excess of this is the change due to the same cause between spring and summer.

From these examples it will be apparent how great are the possibilities of usefulness for the recording spectrobolometer in connection with the study of atmospheric absorption, now that the bolometer has reached the present stage of perfection.[4] A bolograph of the solar spectrum from the violet down to a wave length of 2.5μ is now taken in a quarter of an hour more perfectly by far than could be obtained in two entire years' work at Allegheny, showing the principal absorption lines both in the visible and infra-red spectrum, with sufficient accuracy and detail for purposes of study. The apparatus with certain accessories for standardizing purposes can be used for actinometry, either of the total solar radiation or, what is more valuable, for minute portions of the spectrum. Such researches can not but add, it would seem, to the knowledge of the physics of the atmosphere of the earth, and may even extend to what is possibly of equal importance to us, the study of the atmosphere of the sun.

I have elsewhere ventured the hope that such steps as these may lead to advances in the way of long range forecasting of the weather.

My hopes have, possibly, been regarded as unduly optimistic by many who may have understood me to anticipate a something of speedy attainment. I fully recognize how dimly we can grasp the problem with our present knowledge, but I think I see, in researches which teach us more of the effects and changes of our atmosphere as a whole and in part, and of the sun's atmosphere as a whole and in part, something which will make the problem before us—one which concerns all life in this world—real and definite, and finally largely, if not wholly, solvable.

I can not conclude this brief article without saying that in the beginning this work was strictly mine, the bolometers which were originally used in it having been made throughout with my own hands, but now, owing to other cares and interruptions from administrative duties there is hardly

[3] Mr. Very, in a recent number of this REVIEW, correctly points out that the two first mentioned of these bands are due to water vapor, though this is not so stated in the first edition of the Annals. This error is corrected in a later edition prepared as a Senate document.

[4] I have elsewhere remarked (Philosophical Magazine, July, 1901), that the accuracy as well as delicacy of the bolometer may be considered (1) in regard to its sensitiveness to small amounts of heat; (2) to the accuracy of measurement of those small amounts; and (3) to the accuracy of its measurements of position. As to the first, while it was considered to be remarkable twenty years ago that a change of temperature of one ten-thousandth of a degree could be registered, it is believed now that with the last improvements which Mr. Abbot of the observatory of this institution has lately introduced into the galvanometer, less than one one-hundred-millionth of a degree in the change of temperature of the strip can ordinarily be registered; that as to the second relationship, while careful photometric measures imply a probable error of 1 per cent, the error with the bolometer is insensible and is at any rate less than one-fiftieth of this amount; and that as to the accuracy of its measures of position, in place of an error of a considerable fraction of a degree, as in Lamansky's work, the probable error in feeling the relative position of one of these invisible lines is less than one second of arc, a statement which might hardly appear credible but which is correct.

any part of the experiments, or of the volume which describes them, in which I have not been helped by Mr. C. G. Abbot of this observatory, whose aid I have had pleasure in elsewhere acknowledging.

HAWAIIAN CLIMATOLOGICAL DATA.

By CURTIS J. LYONS, Territorial Meteorologist.

GENERAL SUMMARY FOR MAY, 1902.

Honolulu.—The level of water in artesian wells fell during the month from 34.10 to 33.05 feet above mean sea level. May 31, 1901, it stood at 33.20. The average daily mean sea level for the month was 9.76 feet, 10.00 representing the assumed annual mean. Trade wind days, 31 (5 of north-northeast); normal, 24; average force of wind (during daylight), Beaufort scale, 3.2; cloudiness, tenths of sky, 4.7; normal, tenths of sky, 4.4.

Rainfall data for May, 1902.

Stations.	Elevation.	Amount.
HAWAII.		
HILO, e. and ne.	*Feet.*	*Inches.*
Waiakea	50	13.35
Kaumana	1,250	21.74
Pepeekeo	100	12.55
Hakalau	200	18.63
Honohina	300	19.02
Laupahoehoe	500	29.99
HAMAKUA, ne.		
Kukaiau	250	17.51
Paauhau (Mill)	300	11.90
Kukuihaele	700	16.24
KOHALA, n.		
Niulii	200	11.48
Kohala (Mission)	521	10.84
Kohala (Sugar Co.)	235	11.86
Waimea,	2,720	4.45
Puuhue	1,847	4.48
KONA, w.		
Holualoa	1,350	4.40
Kealakekua	1,580	5.33
Napoopoo	25	4.43
KAU, se.		
Honuapo	15	0.53
Naalehu	650	0.71
Hilea	310	0.50
Pahala	850	1.66
Moaula	1,700	1.05
PUNA, e.		
Volcano House	4,000	4.22
Olaa, Mountain View	1,690	15.81
MAUI.		
Waiopae Ranch, s	700	0.00
Kaupo (Mokulau), s.	285	2.88
Haiku	700	8.14
Kula (Waiakoa)	2,700	1.93
Puuomalei	1,400	10.33
Haleakala Ranch	2,000	3.29
Wailuku	200	1.84
OAHU.		
Punahou (W. B.), sw.	47	1.34
OAHU—*Continued.*		
Makiki Reservoir	120	1.35
U. S. Naval Station, sw.	6	0.24
Kapiolani Park, sw.	10	0.00
Manoa (Woodlawn Dairy), c.	285	7.63
Manoa (Rhodes)	300	11.33
School street (Bishop), sw.	50	1.05
Insane Asylum, sw.	30	1.09
Kalihi-Uka, sw.	260	7.02
Nuuanu (W. W. Hall), sw.	50	0.95
Nuuanu (Wyllie street), sw.	250	2.50
Nuuanu (Luakaha), e.	850	12.14
Waimanalo, ne.	25	0.68
Maunawili, ne.	300	4.91
Ahuimanu, ne.	350	12.96
Kahuku, n.	25	1.11
Ewa Plantation, s.	60	0.24
Waipahu, s.	200	0.00
Moanalua, sw.	15	0.45
KAUAI.		
Lihue (Grove Farm), e.	200	2.03
Lihue (Molokoa), e.	300	1.71
Lihue (Kukaua), e.	1,000	5.27
Kealia, e.	15	1.00
Kilauea, ne.	325	5.75
Hanalei, n.	10	14.92
Haena	15	14.05
Eleele, s.	200	0.12
Wahiawa Mountain, s.	2,100	12.26
McBryde (Residence)	850	1.95
Lawai	450	3.21
East Lawai	10	2.81
West Lawai	200	1.86
Delayed April reports.		
Kailua		1.20
Moaula		1.50
Wahiawa Mount, e		18.25
Eleele		0.95
Kula		0.54

NOTE.—The letters n, s, e, w, and e show the exposure of the station relative to the winds.

Approximate percentages of district rainfall as compared with normal: Hilo, 180; Hamakua, 400; Kohala, 280; Waimea, 160; Kona, 85; South Kau, 45; North Kau, 120; Puna, 110; Maui, varying from 100 to 200; Oahu, 50, except Ahuimanu, 200; South Kauai, 66; North Kauai, 150.

Mean temperatures: Pepeekeo, Hilo district, 100 feet elevation, average maximum, 76.0°; average minimum, 68.5°; Waimea, 2,730 elevation, 73.4°, and 62.4°; Kohala, 521 elevation, 75.4° and 65.9°; Waiakoa, Kula, Maui, 2,700 elevation, 81.7° and 58.5°; United States Magnetic Observatory, 50 elevation, 85.5° and 65.7°; Ewa Mill, 50 elevation, 81.4° and 66.7°.

Mr. Fleming, at the Magnetic Observatory, reports 9 a. m. dew-point, 62.5°; relative humidity, 57.5; 9 p. m., 62.3° and 73.5; Ewa, mean dew-point, 64.4°; humidity, 70.5; Kohala, 65.6° dew-point; 80 humidity.

Heavy surf 3d, 18th, and 30th. Earthquakes reported, none. Snow fell on Mauna Kea 3d and 4th. Thunder and lightning, Oahu, 12th. Marked haze 10th. "After-glow" (with solar haze), probably from the smoke of the Martinique eruption, reported from Hawaii 21st; first seen on Oahu 22d, and continued thereafter, red for first two or three evenings, then more gray-green and yellow-green effects. Solar haze by day tinged with violet ray, afterwards white.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18′ N., 157° 50′ W.

Hawaiian standard time is 10h 30m slow of Greenwich time. Honolulu local mean time is 10h 31m slow of Greenwich.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, May, 1902.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.								Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	29.99	70	65.5	79	68	61.3	67	ne.	2–4	5	30.01	29.95	0.00
2	30.00	69	67	78	68	62.5	70	ne.	3–5	5	30.04	29.98	0.20
3	29.95	70	65	74	68	66.3	86	ne.	2–3	10–6	30.04	29.95	0.15
4	29.94	67	61.5	75	68	62.0	73	ne.	3–5	10	30.00	29.94	0.00
5	29.94	64	61	76	67	56.0	62	nne.	4	2	29.99	29.90	0.00
6	29.89	62	59.7	76	60	58.7	70	ne.	3–4	7	29.98	29.87	0.00
7	29.94	68	63.7	76	59.5	58.7	70	nne.	1–3	8–5	29.96	29.88	0.00
8	29.95	63	61	77	64	61.3	72	ne.	3–0	10	29.99	29.91	0.00
9	29.96	70	63.5	78	62	59.0	66	nne.	3	1	30.01	29.89	0.01
10	30.00	70	63.5	78	66	62.5	70	ne.	3–5	2–8	30.05	29.95	0.00
11	30.06	70	65	76	69	60.5	69	nne.	5–3	3	30.10	29.99	0.00
12	30.05	72	67	78	69	61.3	69	ne.	3	3	30.11	30.03	0.00
13	30.04	70	69.3	79	71	66.3	77	ne.	3	8	30.10	30.03	0.33
14	30.07	72	69	80	69	67.7	81	ene.	3–1	6	30.12	30.04	0.07
15	30.10	72	65	80	71	64.7	72	ne.	3–5	4	30.14	30.06	0.00
16	30.09	72	65.5	79	70	61.3	66	ne.	4	3–6	30.13	30.03	0.02
17	30.07	72	68	79	68	61.3	66	ne.	4	5	30.14	30.07	0.01
18	30.05	68	67.3	81	72	66.5	75	ne.	3	5	30.10	30.01	0.04
19	30.02	66	64.7	82	67	65.7	74	nne.	3–0	3	30.09	29.99	0.00
20	29.98	73	67.5	82	65	65.5	77	ne.	2–0	1	30.04	29.96	0.01
21	30.01	74	69	82	72	65.3	71	ne.	3–1	3	30.06	29.96	0.01
22	30.05	74	68	82	72	66.7	73	ne.	3	5	30.08	29.99	0.00
23	30.06	74	67.5	81	72	66.0	72	ne.	4	5	30.09	30.01	0.04
24	30.06	74	68	81	71	65.3	70	ne.	4	6	30.10	30.02	0.03
25	30.05	73	67	81	72	64.0	68	ne.	3–2	7	30.14	30.06	0.04
26	30.08	72	66.5	78	71	63.7	71	ne.	3–1	8	30.10	30.02	0.12
27	30.09	73	67	80	68	63.3	70	ne.	4–2	6	30.12	30.03	0.01
28	30.08	71	63.5	80	71	63.3	69	ne.	4–5	4	30.14	30.08	0.02
29	30.04	72	65.5	79	69	61.3	66	ne.	3–4	3	30.11	30.02	0.18
30	30.04	73	66	81	69	62.7	67	ne.	4	3–1	30.08	29.98	0.04
31	30.02	72	65.5	80	71	62.7	67	ne.	4	3	30.08	30.01	0.01
Sums.													
Means.	30.022	70.4	65.6	79.0	68.4	63.0	70.7		3.2	4.7	30.072	29.987	1.34
Departure.	+.004					—1.0	+0.4			+0.3			—1.34

Mean temperature for May, 1902, (6+2+9)÷3=73.4; normal is 74.2. Mean pressure for May, 1902, (9+3)÷2=30.033; normal is 30.029.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡ These values are the means of (6+9+2+9)÷4. § Beaufort scale.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

[For tables see page 292.]

Notes on the weather.—In San Jose the pressure was slightly below the normal, the daily means being very low on the 11th (662.87), 23d (662.54), 24th (662.36), 25th (662.86), and 31st (662.57). The highest means occurred on the 1st (664.39) and 16th (664.17). The temperature was slightly above normal and very uniform throughout the month, the relative humidity rather low, and the sunshine normal. On the Atlantic slope the rainfall was generally excessive and was almost uninterrupted at a few stations. At Port Limon the heat and dampness were at a maximum and numerous cases of yellow fever were reported from the Santa Clara district. On the Pacific slope the precipitation during the rainy season just ended has been in marked excess over that of previous years.

Notes on earthquakes.—May 15, 4:27 p. m., very slight shock; May 22, 9:19 p. m., tremors. In connection with the Martinique disaster, it may be noted that on the 11th and 12th especially, and on many other days afterwards, sunrise was accompanied by unusual red and purplish tints, which were noticed not only at San Jose, but also at several other places on the Atlantic slope.

THE WINDS AND RAINFALL OF NEW HAVEN.

By T. H. DAVIS, New Haven, Conn.

THE FREQUENCY OF WIND DIRECTION AS OBSERVED AT THE LOCAL WEATHER BUREAU OFFICE SINCE ITS INSTALLATION IN 1873.

The general circulatory system of the atmosphere is subject to laws that must be discovered by the discussion of continuous observations. This is particularly true of the great equatorial currents which flow away from the equator in the higher strata of the atmosphere, and the corresponding great polar currents flowing from the poles toward the equator in the lower atmosphere. These currents do not travel in direct paths parallel to the lines of longitude, as might at first be supposed, but being perfectly free, the masses of air in motion are subject to the effect of the rotation of the earth on its axis, which causes a deflection of their direction to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

These fundamental currents do not follow continuous courses, but the joint result is the production of what are known as the "prevailing westerlies" near the parallels of forty degrees north and south at the earth's surface.

At southern stations in the United States and about the Gulf of Mexico the prevalent winds have easterly components because of their close proximity to the northeasterly trades.

Cyclonic storms which cross this continent in an easterly or northeasterly direction cause occasional winds of greater or less intensity over districts through which they pass, and these may blow from any point of the compass, depending upon whether the storm center passes through, or north or south of the place of observation. These are factors of more or less importance in determining the prevailing wind direction at any point. Each is more marked in some seasons and in some years than in others, and helps to account for the irregular oscillations of the winds.

If we would embrace all influences liable either individually or collectively to interfere with the general circulation over New Haven, it would be proper to note that its location is as follows:

(1) About 400 miles from the northern edge of the calms of the Tropic of Cancer; (2) in the region of prevailing westerlies; (3) about 300 miles northwest from the average path of the centers of West Indian hurricanes; (4) about 150 miles from the landward margin of the Gulf stream; (5) open to Long Island Sound from southeast to south-southwest; (6) subject to the effects of the Arctic current which is said to flow between the landward margin of the Gulf stream and Long Island Sound.

Any or all of these circumstances may exert a more or less marked interference with the winds that would normally prevail at this point.

The topography of the surrounding country is also a factor in disturbing the wind direction. Winds that blow toward New Haven from the west, north, or northeast meet the Allegheny Mountains of Pennsylvania, the Green Mountains of Vermont, or the White Mountains of New Hampshire, respectively, besides other minor elevations. These rugged eminences, together with their extensive valleys, in considerable measure become deflecting influences on the wind's direction. Insolation and terrestrial radiation also exert influences by producing vertical currents, and these in their turn will materially affect the direction.

Since New Haven is on the coast, winds coming to it from the east, south, or southwest meet with scarcely any obstruction, the only interference being such as is experienced in their passage over the open ocean and the comparatively low-lying land.

The deflecting effects of the topographical character of the country in this vicinity are necessarily very small, but they may possibly be helpful in the explanation of the oscillations of frequency of direction.

One of the important factors to be considered in the investigation of the resultant wind direction for New Haven is its close proximity to the open ocean, by reason of which marked land and sea breezes are developed. These are particularly noticeable during the summer months. On summer mornings and evenings when the general atmosphere is free from observable motion there are distinct movements of large masses of air near the earth, from the land to the sea and from the sea to the land, respectively.

Taking all these points into consideration it will be readily perceived that we do not receive the true winds of the general circulation of the atmosphere, but are favored with resultants due to modifying influences. The directions of wind as observed by Weather Bureau officials at New Haven from 1873 to 1900, inclusive, are shown in Table 1, which gives for each year the percentages of wind frequency for each of the eight points of the compass, the percentage of calms, and finally the resultant directions for each year.[1]

TABLE 1.—*Wind directions in percentages, and annual resultants.*

Year.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.	Resultant direction.
										°
1873	16.7	11.2	2.2	5.5	10.4	14.5	9.0	20.0	10.4	w. 36 n.
1874	16.4	11.2	2.5	3.8	13.4	16.7	10.7	14.8	10.4	w. 18 n.
1875	20.0	15.0	3.6	4.1	13.4	14.8	10.7	14.8	3.6	w. 43 n.
1876	15.9	12.9	2.5	5.2	13.1	17.0	9.3	19.2	5.2	w. 26 n.
1877	17.8	15.1	3.6	3.8	10.4	20.0	6.3	15.6	7.4	w. 40 n.
1878	14.8	13.4	3.3	4.7	13.4	15.3	12.9	16.7	5.5	w. 24 n.
1879	16.4	12.6	2.7	4.1	12.9	18.1	8.5	19.7	4.9	w. 28 n.
1880	17.5	11.0	2.5	5.7	17.3	14.8	12.3	15.9	3.3	w. 14 n.
1881	18.9	15.6	1.9	6.0	13.7	15.1	9.3	12.9	6.6	w. 42 n.
1882	18.4	14.2	1.9	6.3	12.9	16.2	10.1	15.1	4.9	w. 33 n.
1883	18.4	13.4	3.0	6.3	13.1	17.3	9.0	15.6	3.8	w. 31 n.
1884	18.1	12.0	2.7	5.5	12.9	18.1	11.0	14.5	5.5	w. 20 n.
1885	19.7	10.7	3.3	3.8	14.8	14.2	14.0	12.6	6.8	w. 9 n.
1886	12.3	17.0	3.3	6.3	14.5	12.9	13.4	14.0	6.3	w. 26 n.
1887	16.2	12.6	3.8	6.3	14.8	14.2	13.1	15.1	3.8	w. 21 n.
1888	17.5	12.3	3.0	5.7	11.5	15.6	11.8	18.9	3.3	w. 32 n.
1889	11.8	17.0	4.4	5.7	13.4	15.3	13.0	17.3	2.2	w. 27 n.
1890	12.0	15.1	4.1	4.7	13.0	14.0	11.8	19.7	5.7	w. 31 n.
1891	14.2	14.8	3.8	6.6	12.9	18.9	12.0	15.9	1.0	w. 27 n.
1892	15.1	14.5	1.9	6.8	9.9	14.8	18.1	17.0	1.9	w. 28 n.
1893	21.0	17.8	3.6	6.8	7.9	17.3	12.0	13.4	.3	w. 55 n.
1894	21.0	15.1	4.7	5.2	9.6	19.7	12.3	11.8	1.0	w. 38 n.
1895	24.0	7.1	4.1	8.2	14.5	15.1	13.4	13.7	.0	w. 22 n.
1896	24.4	8.5	5.2	4.4	12.6	18.1	12.3	14.5	.3	w. 30 n.
1897	21.6	12.9	2.5	6.8	10.1	17.5	14.2	14.0	.3	w. 33 n.
1898	22.0	15.3	5.5	6.3	13.4	14.5	12.3	10.4	.3	w. 53 n.
1899	18.4	15.9	3.5	5.2	9.9	19.2	9.9	17.2	.8	w. 50 n.
1900	20.0	14.8	4.4	4.1	8.2	19.5	12.6	16.4	.0	w. 41 n.
Mean	17.9	13.6	3.4	5.5	12.4	16.4	11.6	15.4	3.8	w. 31 n.

Table 2 shows the mean percentage of winds from each of the eight points of the compass and the resultant directions for each month of the year.

The components of direction are exhibited graphically in figs. 1 to 4, and the resultant directions in figs. 5 and 6. In fig. 7 are shown resultant directions for the four seasons.

These curves show very clearly the march of the various winds during the year. From fig. 1 we see that the south winds have a maximum frequency in July and a minimum in

[1] From August 25, 1872, to October 31, 1879, observations were made at 7:35 a. m., 4:35 and 11:35 p. m., Washington time; from November 1, 1879, to December 31, 1884, at 7 a. m., 3 and 11 p. m., Washington time; January 1, 1885, to December 31, 1886, at 7 a. m., 3 and 11 p. m., seventy-fifth meridian time; January 1, 1887 to June 30, 1888, at 7 a. m., 3 and 10 p. m., seventy-fifth meridian time; July 1, 1888, to date, at 8 a. m. and 8 p. m. seventy-fifth meridian time. The resultant directions in Tables 1 and 2 are based on observations of wind direction only, and do not take into account variations in the average velocity for different directions.—ED.

December, while the north winds have their maximum in January and their minimum in June. The seasonal fluctuations are much more marked in the south than in the north winds.

TABLE 2.—*Wind directions in percentages, and monthly resultants.*

Months.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.	Resultant direction.
										°
January	21.94	15.81	1.61	1.94	5.17	14.51	16.78	18.71	3.55	w. 49 n.
February	20.00	15.00	2.50	3.57	6.43	12.85	13.58	20.00	6.07	w. 53 n.
March	20.33	13.55	3.88	4.84	9.68	11.62	11.62	20.65	3.83	w. 55 n.
April	17.33	15.33	4.00	8.33	13.33	11.33	9.66	17.33	3.36	w. 54 n.
May	12.90	13.22	5.17	11.94	20.33	15.16	7.10	10.33	3.85	w. 72 s.
June	12.00	9.00	4.66	10.00	22.00	19.33	7.33	11.33	4.35	w. 56 s.
July	13.87	8.39	3.23	5.81	22.27	22.27	7.42	12.59	4.15	w. 35 s.
August	15.81	12.90	3.23	6.45	18.07	19.04	8.39	11.29	4.82	w. 15 s.
September	16.66	15.33	4.00	5.33	14.00	18.66	8.33	13.66	4.03	w. 26 n.
October	19.68	14.51	3.23	4.20	8.71	16.78	12.26	17.10	3.53	w. 42 n.
November	20.33	13.33	2.33	2.66	6.99	15.00	18.33	17.66	3.37	w. 40 n.
December	21.62	14.51	0.65	1.61	4.84	17.42	17.74	17.42	4.19	w. 40 n.

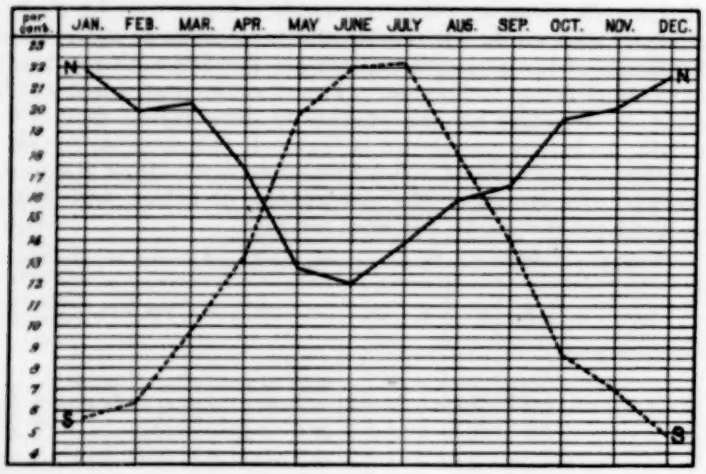

FIG. 1.—Percentage curve of north and south winds, from Table 2.

The curves shown in fig. 2 are not so regular in character as those in fig. 1. The southwest winds have a decided maximum in July and a minimum in April and the northeast winds a minimum in June and July with only slight variations during the remaining months of the year.

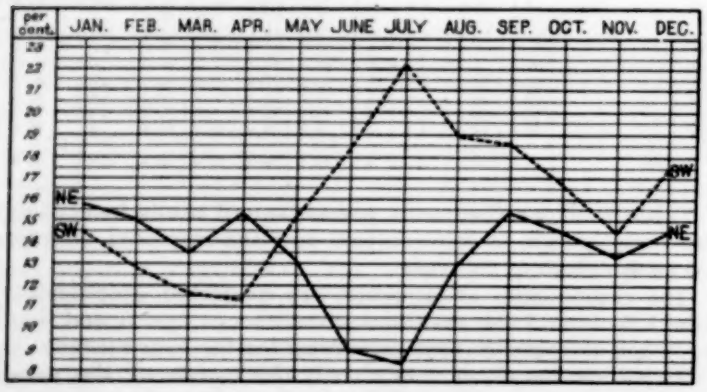

FIG. 2.—Percentage curves of northeast and southwest winds, from Table 2.

Fig. 3 shows a low percentage of east winds throughout the year. West winds are frequent from November to January and comparatively few from May to September; while northwest winds, as shown by fig. 4, are frequent from October to April and few from May to August. Southeast winds show a decided maximum in May.

The striking feature of these curves is the increased frequency of southerly winds and the decreased frequency of north and west winds during the summer season. This is partly due to monsoon influences, but no doubt the land and sea breezes have an important effect.

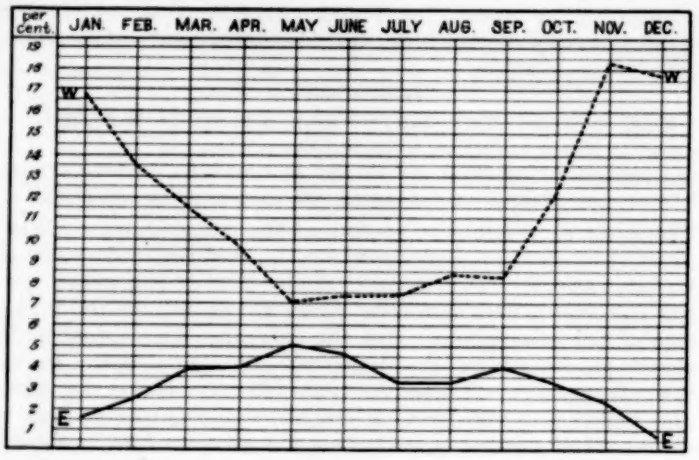

FIG. 3.—Percentage curve of east and west winds, from Table 2.

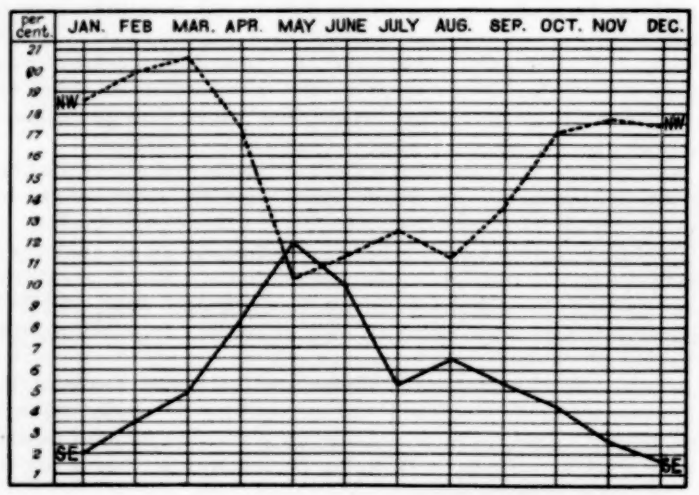

FIG. 4.—Percentage curve of southeast and northeast winds, from Table 2.

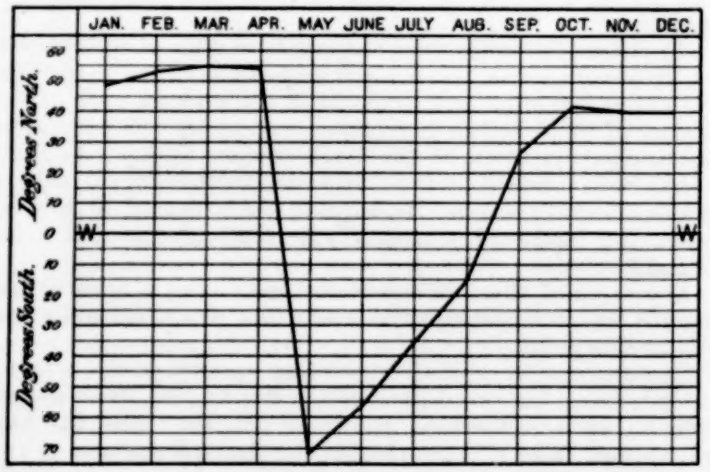

FIG. 5.—Monthly resultant directions, 28-year averages, from Table 2.

PRECIPITATION AT NEW HAVEN, CONN., FOR TWENTY-EIGHT YEARS, 1873–1900.

Precipitation in whatever form it may be deposited upon the surface of the earth appears to be the most erratic and variable quantity with which we have to deal in the discussion of

meteorological phenomena. The rainfall for New Haven, as shown by the measurements taken at the local United States Weather Bureau is apparently almost entirely dependent upon passing storms. There are no high mountains to produce the abundant precipitation that occurs in some other districts, and proximity to the ocean does not appreciably increase its rainfall, since so large a percentage of the winds are from the west or north. The discomfort occasioned by high humidity, fogs, and mists is, however, very generally attributed to its marine position.

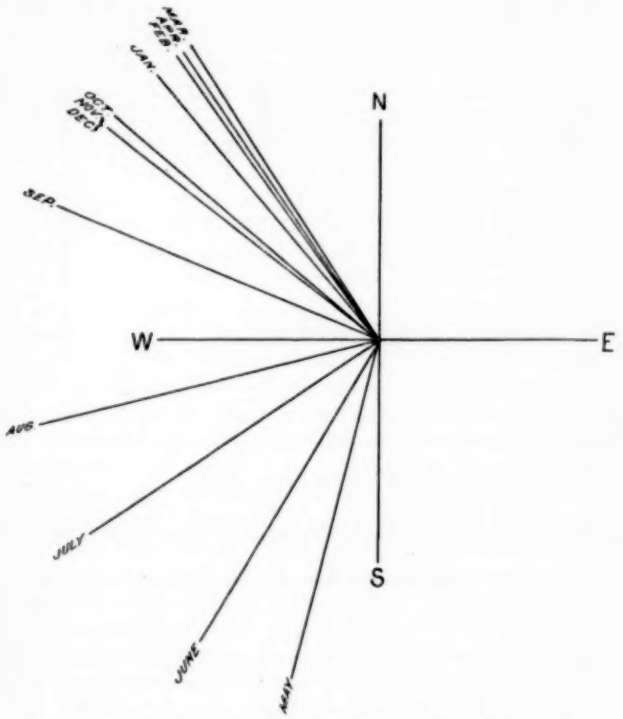

FIG. 6.—Average resultant direction for each month.

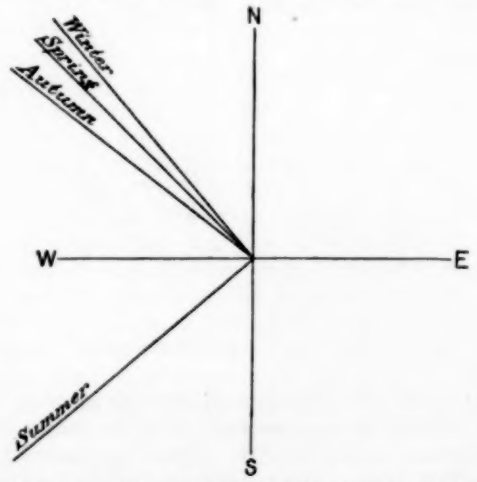

FIG. 7.—Average resultant direction for each season.

As a rule the cyclonic storms that develop in the northwestern part of the United States cross this country in an easterly direction, passing out to sea through the St. Lawrence Valley; they usually bring rain to New Haven. Another class of storms originates in the southwest. They travel in a northeasterly direction and pass out to sea at a point between Cape Hatteras and northern Maine; of these a goodly proportion pass over or near New Haven, producing abundant rains. We also receive a very fair share of rainfall from the so-called West Indian storms.

In addition to the precipitation accompanying these storm areas we are favored with frequent heavy showers of rain during the hot summer months, which approach this point from the northwest or the southwest, and are usually accompanied by the well known thunderstorm phenomena. This no doubt accounts for the fact that on the average for twenty-eight years July proves to be the wettest month of the year in New Haven.

The annual average rainfall recorded at New Haven is 47.38 inches. It is quite possible that the actual rainfall is in excess of this amount by from 5 to 10 per cent, since it has been shown by long series of observations that a rain gage at a high elevation generally collects less rainfall than one placed on the ground. For this reason, Prof. Alfred J. Henry, in his excellent memoir on the "Rainfall of the United States,"[1] informs us that:

> In general it does not seem possible to avoid the conclusion that the absolute amount of precipitation, as registered by the Weather Bureau gages, falls short of the true amount by quantities varying from 5 to 10 per cent of the annual.

The rain gage used in the observations at New Haven is provided with a funnel 8 inches in diameter and the elevation of the top rim of this funnel is 110 feet above ground or about 140 feet above mean sea level. The observer informs me that it has not been moved from its present position on the roof of the building where the local Weather Bureau is situated since its installation in 1873; therefore, the results are eminently reliable for that particular spot.

Table 3 gives a complete record of the amount of rain, measured in inches and hundredths, for each month; the totals for each year of the 28-year period under consideration; the departures from the normal; and the average for the period elapsing since 1872. This latter shows the necessity of a long period of observations before the adoption of a mean. At the bottom of the table are given the means for each month for the entire period, which show that, on the average, July is the wettest month and June the driest.

TABLE 3.—*Monthly, annual, and average precipitation.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total annual.	Average.	Departure from normal.
1873...	7.42	3.45	4.01	4.95	6.27	2.07	1.55	9.90	2.12	6.18	4.73	4.41	57.06	57.06	+ 9.68
1874...	4.29	3.87	1.34	7.89	4.92	3.41	4.90	12.99	4.07	1.86	3.44	2.85	55.82	56.44	+ 8.44
1875...	2.72	3.98	3.24	3.28	2.71	3.50	4.42	5.56	2.10	3.18	7.44	1.39	43.52	52.13	− 3.86
1876...	1.54	4.29	10.15	7.63	3.12	1.86	11.05	1.20	5.34	1.12	4.43	2.38	54.11	52.63	+ 6.73
1877...	2.60	1.07	8.09	3.44	2.14	6.17	2.37	5.69	1.13	10.09	7.11	1.46	51.36	52.37	+ 3.98
1878...	6.80	6.40	4.18	5.08	3.75	2.62	2.53	4.93	7.67	2.33	6.33	5.50	58.12	53.33	+10.74
1879...	2.69	3.89	5.82	6.08	3.22	4.62	9.50	9.40	2.13	1.41	2.33	4.41	55.50	53.64	+ 8.12
1880...	3.75	3.80	5.68	3.69	1.24	1.21	4.90	8.14	3.73	4..7	2.82	3.49	46.52	52.75	− 0.86
1881...	4.79	6.17	10.42	1.71	3.89	5.14	3.53	2.51	1.45	2.78	4.18	4.75	51.32	52.59	+ 3.94
1882...	5.91	4.52	3.59	1.55	5.05	2.74	3.03	0.26	13.43	3.54	1.31	2.99	47.92	52.12	+ 0.54
1883...	3.60	5.00	1.64	2.23	4.52	1.83	5.67	1.26	2.43	5.87	1.56	3.85	39.46	50.98	− 7.92
1884...	4.63	5.57	4.15	2.36	3.32	5.26	5.89	5.60	1.41	2.49	2.24	6.41	49.33	50.84	+ 1.95
1885...	4.05	3.15	1.19	2.31	2.61	1.43	2.51	8.13	0.77	5.37	3.49	3.31	38.32	49.87	− 9.06
1886...	3.53	5.95	3.20	3.21	2.74	2.84	4.69	4.56	2.35	1.95	3.83	3.47	42.32	49.33	− 5.06
1887...	4.24	6.22	4.22	2.75	0.18	5.62	4.66	4.80	2.21	3.24	2.85	3.09	44.08	48.98	− 3.30
1888...	5.48	3.16	7.46	2.57	6.03	2.15	1.76	7.10	7.68	6.46	4.73	5.68	60.26	49.69	+12.88
1889...	4.47	2.08	1.44	4.01	3.81	3.17	17.08	4.38	4.98	3.96	7.78	2.62	59.78	50.28	+12.40
1890...	3.07	3.19	6.60	2.89	4.24	3.12	6.59	2.67	5.38	7.63	0.67	2.90	48.95	50.21	+ 1.57
1891...	6.77	5.88	3.68	2.35	1.92	1.90	4.52	3.14	3.96	4.62	2.21	3.74	44.69	49.92	− 2.69
1892...	5.39	1.56	3.07	1.31	5.11	2.36	4.33	4.99	1.54	0.94	5.46	1.72	37.78	49.31	− 9.60
1893...	3.47	6.23	4.50	3.84	7.08	2.07	1.89	4.86	2.24	4.75	2.56	3.22	46.71	49.19	− 0.67
1894...	2.74	4.23	1.15	2.24	4.49	0.49	2.40	1.70	4.63	6.11	4.23	3.33	37.74	48.67	− 9.64
1895...	5.13	0.99	2.36	3.11	1.70	2.41	3.77	3.91	2.51	3.32	4.84	1.91	35.96	48.11	−11.42
1896...	1.82	5.65	5.61	1.19	3.67	2.96	3.86	2.57	3.42	2.91	2.33	2.40	38.39	47.71	− 8.99
1897...	3.85	2.00	3.66	2.44	5.03	2.47	16.63	6.81	2.42	1.25	5.72	5.61	57.89	48.12	+10.51
1898...	4.96	4.55	2.54	4.43	8.03	0.21	5.03	6.65	2.30	7.22	5.69	2.11	53.72	48.33	+ 6.34
1899...	4.33	3.39	7.28	1.79	2.52	2.59	4.17	0.65	3.33	1.78	1.89	1.56	35.28	47.85	−12.10
1900...	3.60	6.39	4.21	1.95	3.30	1.79	2.28	0.90	2.10	2.03	4.14	2.14	34.83	47.38	−12.55
Means	4.20	4.17	4.44	3.30	3.81	2.79	5.19	4.83	3.53	3.87	3.94	3.31	47.38		

Some precipitation was recorded during every month of the entire twenty-eight years, the nearest approach to zero being 0.18 inch in May 1887. On a few other occasions the precipitation was considerably below one inch, viz:

August, 1882, 0.26 inch; September, 1885, 0.77 inch; November, 1890, 0.67; June, 1894, 0.49 inch; June, 1898, 0.21 inch.

[1] Weather Bureau Bulletin D, p. 9.

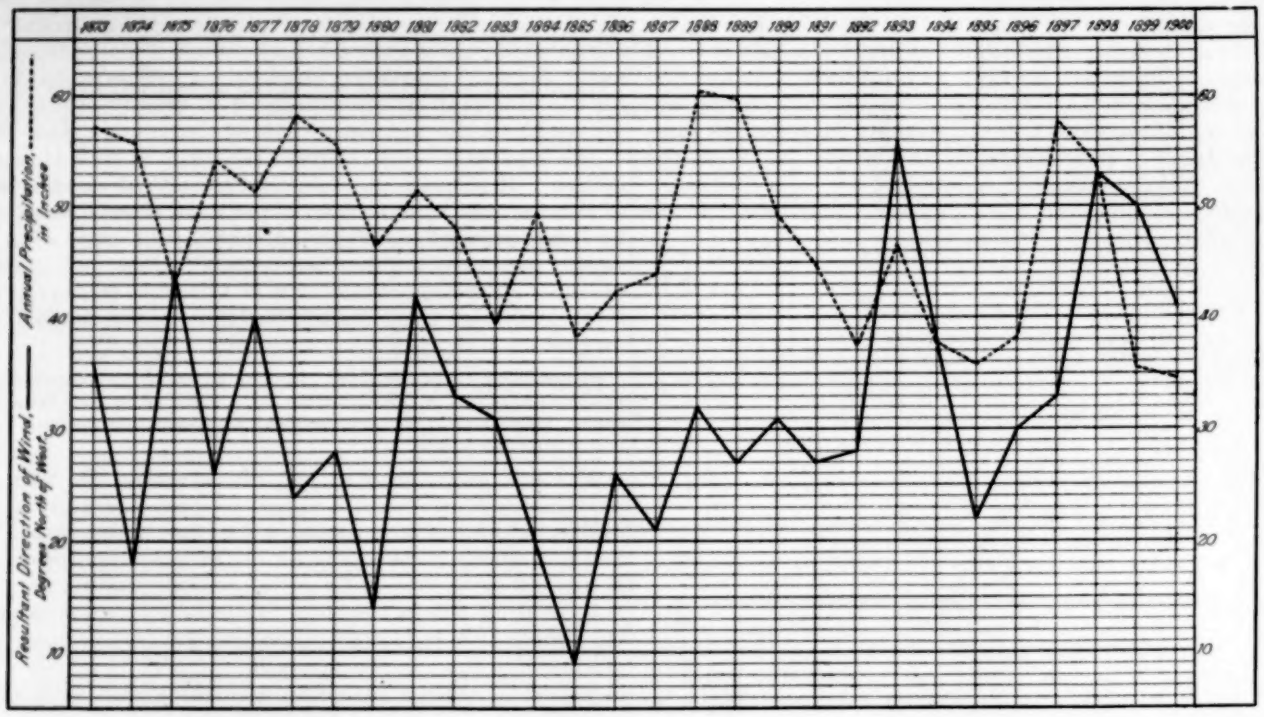

FIG. 8.—Annual precipitation and resultant direction of all winds observed at New Haven, Conn.

On the other hand the maximum falls for any month were as follows:

August, 1874, 12.99 inches; March, 1876, 10.15 inches; July, 1876, 11.05 inches; October, 1877, 10.09 inches; March, 1881; 10.42 inches; September, 1882, 13.43 inches; July, 1889, 17.08 inches; July, 1897, 16.63 inches.

The total amount of precipitation for the entire twenty-eight years was 1,326.74 inches, and the percentages for each month during this period were as follows:

January, 8.87; February, 8.79; March, 9.38; April, 6.96; May, 8.03; June, 5.88; July, 10.97; August, 10.19; September, 7.45; October, 8.18; November, 8.33; December, 6.98.

Adopting a seasonal division we have for twenty-eight years—

Season.	Total.	Percentage.	Average.
	Inches.		*Inches.*
Spring months	323.37	24.37	11.55
Summer months	358.78	27.04	12.81
Autumn months	317.63	23.94	11.34
Winter months	326.96	24.65	11.68
Year	1,326.74	100.00	47.38

It will be observed that for New Haven the summer months show greater precipitation than any other part of the year.

In fig. 8, I have plotted the rainfall for each year from 1873 to 1900 to ascertain if there is a periodicity in the fluctuations of the amount. The resulting curve does not establish any such periodicity. Comparing it with the resultant curve for wind direction at New Haven in the same figure, it will be noted that there appears to be only a slight relation between the two. This is a subject for further investigation, however.

EARLY RAINFALL RECORDS.

During the writing of this paper, Prof. Willis L. Moore, Chief of the Weather Bureau, very courteously supplied me with a copy of records of precipitation at New Haven for a continuous period of eighteen years (with the exception of August 1805), commencing nearly one hundred years ago, viz: 1804–1821. These interesting records are shown in Table 4.[3]

TABLE 4.—*Monthly and annual precipitation, 1804–1821.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total annual.
1804	4.76	2.28	4.12	3.60	3.07	2.39	3.32	1.35	4.90	6.07	3.21	4.32	43.30
1805	6.93	1.95	2.29	2.65	3.92	2.71	0.86	3.88*	1.65	6.75	3.20	4.10	*40.80
1806	3.20	1.87	1.67	2.90	1.82	1.50	3.60	6.80	5.60	0.70	6.15	2.80	38.61
1807	3.80	7.80	3.90	4.75	5.60	2.43	4.32	5.60	1.32	1.45	1.45	4.10	45.32
1808	4.38	2.85	2.70	2.95	9.35	4.08	8.55	0.73	4.37	2.94	2.00	4.50	49.40
1809	4.70	3.14	2.42	3.58	2.23	4.34	4.81	4.38	0.14	5.12	2.39	7.30	44.55
1810	1.46	1.22	2.89	2.67	1.31	4.17	6.88	5.35	1.55	2.03	8.34	1.53	39.40
1811	3.32	5.01	3.69	2.73	1.83	1.89	6.24	5.30	1.88	5.44	4.37	5.96	47.66
1812	4.66	4.28	1.63	3.32	3.51	3.42	4.19	5.55	3.51	4.45	3.63	3.22	44.17
1813	4.54	1.38	5.36	3.68	7.33	4.17	4.64	4.11	4.92	5.86	3.91	4.10	53.40
1814	1.60	7.65	3.71	3.82	6.29	3.09	7.03	9.13	3.22	1.23	7.72	1.75	56.06
1815	3.09	3.33	5.27	3.07	3.87	3.88	6.94	4.90	9.79	0.68	2.19	3.63	50.64
1816	3.68	5.45	2.46	2.72	2.81	3.67	1.15	1.61	6.65	4.14	2.81	0.85	38.00
1817	2.59	4.87	3.27	2.80	1.30	8.90	2.46	4.27	2.74	1.15	5.39	3.64	43.38
1818	2.90	2.30	4.00	4.67	6.36	2.49	3.05	1.63	5.79	1.22	1.53	2.08	38.02
1819	1.16	5.16	5.60	3.94	4.31	1.91	1.44	2.65	3.46	1.26	0.65	2.35	33.89
1820	3.15	3.87	5.36	0.86	5.97	0.96	6.23	2.34	2.22	8.80	3.00	3.43	46.19
1821	4.49	5.28	2.32	4.70	3.44	4.60	1.71	1.00	4.74	5.11	4.28	2.97	44.64
Means.	3.58	3.86	3.44	3.30	4.09	3.36	4.27	3.89	3.80	3.58	3.64	3.49	44.30

*The record for August, 1805, is missing. I have inserted for this month the mean for the period.

For this period the average annual precipitation is only 44.30 inches, which is 3.08 inches less than the mean derived from the observations for 1873–1900. The extremes of precipitation are less marked than in the recent period, the greatest monthly amount being 9.79 inches in September, 1815, and the lowest 0.65 inch in November, 1819.

These records were taken at an elevation of 45 feet, nearly 100 feet nearer mean sea level than those of the 28-year period. If we grant that the rain gage used and the methods of measurement were as correct as at the present time, it appears that the precipitation in the early part of the last century was less than now, but had much the same character.

[3] This table is a part of the series, 1804–1829, by Professors Loomis, Olmstead, and others, the means for which are given in Schott's Precipitation Tables, 1872. From 1822–1829, inclusive, the records for many months are missing.—Ed.

A MISSISSIPPI TORNADO.

By S. C. EMERY, Local Forecast Official.

During the afternoon of March 28, 1902, a tornado of considerable violence passed through the northeast portion of Mississippi and northwest Alabama. Its course lay in a direct line from southwest to northeast, through the northern portion of Calhoun County, Miss., where it originated, diagonally across the counties of Pontotoc, Lee, and Itawamba, Miss., and Franklin County, Ala.

The total distance over which the storm traveled was about 118 miles, and its rate of progress averaged 33 miles an hour, the progressive motion being much greater toward the end than at the beginning. The width of the storm's track ranged from 300 to 400 yards. The cloud was generally reported as funnel shaped, and of a greenish yellow color. Hail fell at various places along the storm's track, and in several instances severe hail storms occurred a few miles to the north of the main storm. The hail stones were of unusual size and caused considerable damage in the way of killing sheep and young lambs, breaking windows, etc. Though a large number of dwellings were destroyed, only two people are reported killed.

The tornado formed about 1:30 p. m at a point 12 miles east of the village of Banner, Calhoun County, Miss. From there it moved northeast into Pontotoc County, passing about 1½ miles south of Randolph, a small village in the southwest corner of that county, reaching that place about 2 p. m. The cloud is described by an eye witness at Randolph as being funnel shaped and very black, and accompanied by remarkably severe thunder and lightning and heavy rain mixed with hail, some of the hail being "as large as an inkstand." South of of the storm the wind came from the southeast and on the north side from northeast. Everything within the path of the storm was destroyed, and quite a number of people injured. One child was taken into the air and deposited in a tree top, where it was afterwards found with all the clothing stripped from its body except its shoes.

From Randolph the storm continued its northeast course to the village of Algoma, which was almost entirely destroyed, then on past Plymouth which it skirted to the south, reaching Tupelo, Miss., at 2:40 p. m. The damage at Tupelo was considerable, 75 negro cabins being completely destroyed, and many substantial buildings wrecked. From Tupelo the storm continued through Itawamba County, Miss., and crossed the Alabama line at the southwest corner of Franklin County. The first town in Alabama lying within the storm track was Isbell, which it reached about 3:45 p. m. Two churches were blown down, several dwellings more or less wrecked, and a large number of negro cabins destroyed. A cedar tree about 12 inches in diameter, which stood a few feet from a warehouse, was twisted off about 5 feet from the ground, and hurled through the building to the opposite side of the street, while the building itself was practically uninjured. After leaving Isbell it appears to have either lost its tornadic character, or as is more probable, passed some distance above the surface. That the storm continued its northeast course is shown by the severe wind and hail storms that occurred at points in a direct line with the course over which it had hitherto moved, the most notable being at Newburg, Mount Hope, and Moulton.

The weather map of March 28 presented an oval shaped low, which extended from Texas to the central Mississippi Valley, with comparative highs over the Northwest and Southeast. The heavy and almost unprecedented downpours of rain that had prevailed for forty-eight hours over a greater portion of Tennessee, Alabama, and Mississippi were still in progress, and as a result many of the rivers were in a state of flood and a large section of country was covered more or less with water. Thunderstorms were generally reported in Texas, Louisiana, Arkansas, Tennessee, Missouri, and Illinois. The temperature over the southeast quadrant of the low averaged about 70°, while in the far Northwest it was below freezing.

At Memphis on the day in question rains continued all day, with frequent heavy downpours. Dense fog formed in the west at intervals during the afternoon, and as it passed through the Arkansas forest the tree tops only could be seen, the trunks being hidden by the white cloud bank. Two or three of these cloud banks, which seemed to roll onward, passed over the station, indicating the presence of cold currents of air coming from above.

The following extracts relative to the excessive precipitation in Mississippi and Tennessee on March 26–28 are of interest in connection with the foregoing, and are taken from the section reports of these States:

The almost continuous rainfall from March 26 to 28, inclusive, over the central and northern portions of Mississippi was one of the most excessive and destructive on record for the State. In the northern two-thirds of the State the average rainfall for the three days was 7.72 inches; at twelve stations within this area the rainfall exceeded 8 inches, and at two stations, Agricultural College and Ripley, the amounts of precipitation for the three days were 10.78 and 11.76 inches, respectively. The following 24-hour rainfalls, which are the heaviest on record at the stations named, occurred as follows: Jackson, 6.28 inches; Lake, 6.12; Ripley, 8.56; University, 6.06; Vicksburg, 7.12, and Walnut Grove, 8.28.

On March 28 occurred the most disastrous floods in middle Tennessee of which there is any record. For twenty-five stations, in as many different adjoining counties, there was an average rainfall of 5 inches in less than twenty-four hours; for four stations, in adjoining counties, there was an average of 8.19 inches within twenty-four hours. The heaviest rainfall occurred over a territory stretching from Hardin County northeastward, and including Wayne, Lawrence, Lewis, Maury, Giles, Marshall, Williamson, Rutherford, Bedford, Coffee, Warren, White, Smith, Cumberland, Roane, and Morgan counties. The amount of rainfall at Lewisburg on the 28th, 9 inches in twenty.three hours, is the greatest recorded amount that has fallen in that length of time in this State since the records of this service began, twenty years ago; it is probably unprecedented in the history of middle Tennessee. On the same day, at Lynnville, 8.45 inches fell, at Iron City, 7.70, and at Palmetto, 7.60, indicating that the four counties, Lawrence, Giles, Marshall, and Bedford, comprised the area of heaviest rainfall in the flood-stricken territory.

A correspondent at Burnsville. Miss., near the northeast corner of the State, and about forty miles northwest of the path of the tornado, describes the rainfall at that place as the most terrific ever experienced. He says:

The most remarkable feature of the storm was the falling of what we suppose to be waterspouts along the range of hills west of Yellow Creek Great holes were washed out of the sides of the hills, the dirt and rock. being carried for considerable distances. Saplings and stumps and even trees were washed out of the ground, and in some instances carried from 50 to 100 yards from where they stood. * * * Nothing of the kind has ever occurred in this country before, as the surface would surely reveal it if it had occurred within the last 100 years."

Results such as described above are often produced by the excessive rains, called "cloud bursts." The creeks and drainage courses that ordinarily suffice to carry off the rainfall, overflow, and new passages are cut by the swift flowing water. Waterspouts form only over the sea and could not have occurred at Burnsville as suggested by our correspondent.

The floods that resulted from this storm are described under the heading Rivers and Floods, in the March and April numbers of the REVIEW.—*H. H. K.*

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

London, Edinburgh, and Dublin Philosophical Magazine. London. 6th Ser. Vol. 3.

Lewis, Percival. The Role of Water Vapour in Gaseous Conduction. Pp. 512–515.

Beattie, J. C. The Magnetic Elements at the Cape of Good Hope from 1605 to 1900. Pp. 532–541.

Townsend, John S. The Conductivity produced in Gases by the Aid of Ultra-violet Light. Pp. 557–576.

Symons's Meteorological Magazine. London. Vol. 37.

—— Probable Weather of the Last Week in June. Pp. 65–68.

Curtis, R. H. The West Indian Volcanic Eruptions and Atmospheric Phenomena. Pp. 68–70.

Proceedings of the Royal Society of London. London. Vol. 69.

Armstrong, Henry E. The Conditions determinative of Chemical Change and of Electrical Conduction in Gases, and on the phenomena of Luminosity. Pp. 99–109.

Quarterly Journal of the Royal Meteorological Society. London. Vol. 28.

Hepworth, M. W. Campbell. Atmospheric Dust. P. 68.

Shaw, W. N. "La Lune mange les Nuages." A Note on the Thermal Relations of Floating Clouds Pp. 95–100.

Dines, W. H. The Element of Chance applied to various Meteorological Problems. Pp. 53–68.

Mawley, E. Report on the Phenological Observations for 1901. Pp. 69–94.

Journal of the Franklin Institute. Philadelphia. Vol. 153.

Keller, H. F. The Gases of the Atmosphere. Pp. 419–430.

Nature. London. Vol. 66.

Cole, Grenville A. J. Sun-pillar and Parhelion. P. 32.

L., W. J. S. Dust-falls and their origins. Pp. 41–42.

Herschel, W. J. Sun Pillar. P. 77.

Mac Dowall, Alex. B. Brückner's Cycle and the Variation of Temperature in Europe. Pp. 77–78.

Dewar, James. Thermal Expansions at Low Temperatures. Pp. 88–90.

Clayton, Henry Helm. Volcanic Eruption in Java, Brilliant Sunset Glows in 1901, and probable Glows from the Eruption in Martinique. Pp. 101–102.

Omond, R. T. A Solar Halo. P. 103.

—— Sea Temperature and Shore Climate. P. 116.

—— Evidence of a "Seiche" on a Scottish loch. Pp. 162–163.

Scientific American Supplement. New York. Vol. 53.

—— Dust-Falls and their origin. P. 22111.

—— D'Arsonval on Liquid Air. Pp. 22117–22118.

Marconi, Guglielmo. The Practicability of Wireless Telegraphy. Pp. 22150–22151.

Science. New York. Vol. 15.

Clayton, Henry Helm. The Volcanic Eruption in Martinique, and possibly coming Brilliant Sky Glows. Pp. 791–792.

Abbe, Cleveland. Indian Summer. [Note on article by Albert Matthews.] P. 793.

Verrill, A. E. The Mud Shower. P. 872.

Abbe, Cleveland. Meteorology in Argentina. P. 875–876.

Ward, R. DeC. [Note on] Monthly Weather Review. Pp. 914–915.

Ward, R. DeC. Some Physiological and other effects of Sunshine and Shade. [Note on paper by M. Lugeon.] P. 915.

Ward, R. DeC. [Note on] Meteorological Annual of the Royal Belgian Observatory. P. 915.

Diller, J. S., and Steiger, George. Volcanic Dust and Sand from St. Vincent caught at Sea and the Barbados. Pp. 947–950.

Comptes Rendus de l'Académie des Sciences. Paris. Tome 134.

Branly, Edouard. Récepteur de télégraphie sans fil. Pp. 1197–1199.

Féry, Ch. Sur la température de l'arc électrique. Pp. 1201–1204.

Nordmann, Charles. Sur la constitution des nébuleuses. Pp. 1282–1285.

Deslandres, H. Rapprochements entre les épreuves de la couronne solaire de l'éclipse totale du 18 mai 1901 et les photographies de la chromosphère entière du soleil, obtenues le même jour à Meudon. Pp. 1285–1288.

Curie, Jacques, et Compan, P. Sur le pouvoir inducteur spécifique des diélectriques aux basses températures. Pp. 1295–1298.

Décombe, L. Sur les variations de la lumière zodiacale. Pp. 1352–3.

La Nature. Paris. 30me Année.

Espitallier, G. Le ballon dirigeable Severo.

Plumandon, J. R. La durée des chutes de grêle. Pp. 406–408.

Lecornu, J. Les ascensions en cerf-volant. Pp. 410–412.

L'Aérophile. Paris. 10me Année.

Besancon, Georges. La catastrophe du "Pax." Pp. 97–113.

Archives des Sciences Physiques et Naturelles. Genève. 4me Période. Tome 13.

Gautier, R. Observations météorologiques faites aux fortifications de Saint-Maurice pendant l'année 1901. Pp. 462–490.

Annales de Chimie et de Physique. Paris. 7me Série. Tome 26.

Stassano. Sur la nature et la constitution du spectre des aurores polaires. 7me Série. Tome 26.

Ciel et Terre. Bruxelles. 22me Année.

De Heen, P. La Périodicité de l'activité solaire, la production des "Novæ" et l'état fragmentaire des uranolithes, interprètés par l'iodynamisme. Pp. 172–175.

Geographische Zeitschrift. Leipzig. 8 Jahrgang.

—— Ueber die Höhen der verschiedenen Wolkenformen. P. 289.

Lindeman, Moritz. Die neueren Reisen zur Erforschung der Nordpolarregion. Pp. 305–322.

Das Wetter. Berlin. 19 Jahrgang.

Grohmann, —. Die klimatischen Verhältnisse des Königreiches Sachsen in ihrer Abhängigkeit von Luftdruck und Windursprung. Pp. 97–108.

—— Uebersicht über die Witterung in Central-Europa im März 1902. Pp. 109–110.

Meinardus, M. Die Temperaturverhältnisse im März 1902 unter etwa 50° N. Br. P. 110.

Brückner, Ed. Der Ursprung des Regens. Pp. 110–117.

Gaea. Leipzig. 38 Jahrgang.

Klein, H. J. Lowells neue Untersuchungen über die klimatischen Verhältnisse auf dem Planeten Mars. Pp. 326–330.

—— Der grosse Staubfall vom 9 bis 12 März 1901 in Nordafrika, Süd und Mitteleuropa. Pp. 330–336.

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—— Die deutsche Südpolar-Expedition. Pp. 421–426.

—— Die Mengen der neuentdeckten Gase in der Atmosphäre. P. 435.

—— Höhen der verschiedenen Wolkenformen. Pp. 437–438.

Annalen der Physik. Vierte Folge. Band 8.

Korn, A., and Stoeckl, K. Studien zur Theorie der Lichterscheinungen. Pp. 312–326.

Physikalische Zeitschrift. Leipzig. 3 Jahrgang. Pp. 338–339.

Ebert, H. Galvanometrische Messung des elektrischen Ausgleichs zwischen den Ionenladungen der Atmosphäre und der Ladung der Erdoberfläche. Pp. 338–339.

Lemström, S. Ueber die Messung der elektrischen Ströme der Atmosphäre durch Spitzenapparate. Pp. 396–397.

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Meteorologische Zeitschrift. Wien. Band 19.

Wolfer, A. Die Wolf'schen Tafeln der Sonnenfleckenhäufigkeit. P. 193–200.

Exner, F. M. Langley's neuere Untersuchungen der ultrarothen Sonnenstrahlung. Pp. 200–205.

Bührer, W. Ueber den Einfluss der Schneedecke auf die Temperatur der Erdoberfläche. Pp. 205–211.

Hergesell, H. Vorläufiger Bericht über die internationale Ballonfahrt am 6 Februar 1902. Pp. 211–212.

—— Sonnenschein zu Kimberley. Pp. 212–213.

—— Meteorologische Beobachtungen zu Swakopmund, tropische Westküste von Südafrika. Pp. 213–214.

—— Magnetische Landesaufnahme der Vereinigten Staaten. Pp. 214–215.

—— Die nördlichste Station des Canadischen Beobachtungsnetzes. Pp. 215–216.

—— Rauch als Schutzmittel gegen Spätfröste. P. 216,

—— Wärmestrahlung von Arktur, Vega, Jupiter und Saturn. Pp. 216–217.

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—— Zum Klima von Abbessinien. P. 242.
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Darwin, George Howard. Ebbe und Flut sowie verwandte Erscheinungen im Sonnensystem. Pp. 278–282.
—— Bericht der Deutschen Seewarte über Ergebnisse der magnetischen Beobachtungen in den deutschen Küstengebiete und in den deutschen Schutzgebieten während des Jahres 1901. Pp. 295–299.
—— Magnetische Beobachtungen an Bord der "Valdivia" wärend der deutschen Tiefsee-Expedition 1898–99. Pp. 299–304.

NOTES AND EXTRACTS.

METEOROLOGICAL CONDITIONS FOLLOWING THE ST. VINCENT AND MARTINIQUE ERUPTIONS.

The two nearest stations of the United States Weather Bureau to Martinique are Bridgetown, Barbados, latitude 13° 4′ north, longitude 59° 37′ west, and Basseterre, St. Kitts, latitude 17° 18′ north, longitude 62° 48′ west. St. Pierre, Martinique, is at about latitude 14° 45′, longitude 61° 10′, or 150 miles northwest of Barbados and 200 miles south-southeast of Basseterre. St. Vincent is about 100 miles west of Barbados and nearly 300 miles south-southeast of Basseterre. The observer at Bridgetown, Mr. J. J. O'Donnell, was thus considerably nearer the scene of the eruption than the observer at Basseterre.

In response to a letter sent out by the Chief of Bureau, Mr. O'Donnell forwarded extracts from his daily journal, as follows:

May 7, 1902.—Cloudy; varying conditions of cloudiness overcast the sky in the early morning, upper clouds moving from the west, lower clouds from the east; toward noon the upper clouds began to increase in density, while taking on a somewhat hazy appearance, which at 1 p. m. had a decidedly lurid hue. The cumuli from the east became more compact, and at 1:30 p. m. had assumed a thick and firmly-set mammilated shape, with a decidedly ashen hue. From a point on the western horizon there radiated a conical beam of a greenish or phosphorescent tint, about 50° in length and 20° wide at the base, north and south of which the lurid hue of the cirro-stratus emitted a diffused reddish light. At 2 p. m. the mammilated cumuli had reached the zenith and descended upon and overspread the conical beam, while the sun's disc was overcast only by a dense haze. Beneath the conical beam and generally toward the west the water of the Caribbean Sea presented a calm, quiet, and gently swelling surface of a gruesome, sickly, greenish tint.

Pressure and temperature normal, with light and steady southeast wind after 8:35 a. m.

The unusual phenomena had attracted many persons to the roofs of the houses in the city and several visitors to the Weather Bureau office. At 1:47 p. m. a terrific explosion was heard, followed eight seconds later by another of at least equal intensity, while on the roof at 2:06 p. m. a peculiar rumbling sound, closely resembling the noise of a tornado, was heard, and it seemed to rush close to or through the surface of the ground, rather than through the air. Darkness was rapidly setting in; the air had a strong sulphurous odor, and all persons on the roof of the Weather Bureau office were observing the fishermen yet off the horizon rapidly scudding home to port. At 3 p. m. it was necessary to light lamps in the office, the hotel, and in all business offices not already closed; 3 p. m. being the hour at which all business is usually discontinued for the day. At 3:45 p. m. thunder was heard moving from the west, accompanied by lightning, from 4:15 to 6 p. m.; the thunder was one continuous roar, while the occasional lightning emanated as from a disc about 20 inches in diameter on the western horizon and was at all times of an incandescent character, resembling an electric arc or search light of immense intensity or candle power and always disappearing or vanishing in a purple glow. From 6 to 8 p. m. the thunder was at intervals of eight to ten minutes, but much louder and of a detonating character, but not always preceded by the lightning or electric flash. After 8 p. m. the thunder continued at intervals of fifteen to twenty minutes and did not decrease in intensity, while the brilliancy of the incandescent lightning continued until past midnight.

At 2:15 p. m. some grains of coarse dust, resembling No. 3 gunpowder, fell at the office; from 3:40 to 4 p. m. similar dust fell sparingly and intermittently; from 4 p. m. until past midnight it fell thick and fast without interruption. Impenetrable darkness prevailed from 4:30 p. m., or from one hour before sunset. East winds prevailed until 8:35 a. m. and from 10:50 p. m. until past midnight; southeast winds the rest of the day; maximum velocity, 13 miles per hour.

The shower of dust and the explosion heard at 1:47 p. m. are believed to have been caused by the eruption of the Souffrière on the island of St. Vincent, 100 miles due west from Barbados, and which was reported to have occurred at 12:30 p. m. through the public telegrams received at 2:30 p. m.; the barograph trace indicates a decided jar at 2 and 3 p. m.

Remarks.[1]—Several persons report having heard between 2 and 3 p. m. as many as seven explosions in groups of three, two, and two; many report having heard only four explosions in groups of two and two, and others say they heard only two explosions, and those the last; all agree in saying that the last two were the loudest.

The ordinary height of spring tides is 3 feet; new moon occurred at 6:47 p. m.; the tide was high at 3 p. m. At 3:10 p. m. the water suddenly rose 2.5 feet in two minutes and as rapidly fell after one minute; about three minutes later it rose 1.25 feet in three minutes, and as rapidly fell, then rose about 0.8 foot in two minutes and again rapidly fell. The water rose and fell three times in fifteen or twenty minutes, the rise each time being about one-half what it was before. These measurements were made by Mr. C. B. Sidney, timekeeper for the superintendent of public works, and Mr. Walter C. Ashby, engineer in charge of repairing the wharf destroyed by the hurricane of 1898.

May 8.—Cloudy; the fall of volcanic dust ceased at 5:10 a. m., total depth one-quarter of an inch. Thunder was heard from 1 to 4 a. m. Strato-cumulus, stratus, and scud overcast the sky all day; the atmosphere was muggy, close, and sultry, with dense haze until 3. p. m.

Remarks.—No explosion or thunder was heard during the forenoon, and no change occurred in the water level in the harbor.

May 11.—An exceedingly brilliant orange tinted glow lighted up the whole western sky from 5:30 till 6:45 p. m., which afterwards slowly dissipated, the moon's disc meantime presenting a beautiful ultra-marine blue color.

May 14.—From 5 to 6:30 p. m. the west and northwest sky presented a brilliant orange tinted hue, diminishing in luster and entirely dissipating at 7:10 p. m.

May 20. *Remarks.*—Some persons report having heard two loud explosions in the north at 4:43 a. m [local time]. The barograph trace shows a decided jar at about that time.

Mr. O'Donnell adds in his letter:

It may be remarked that the explosion that preceded the eruption of Souffrière, on the island of St. Vincent on the 7th was as loud, if not louder, than any explosion from Mount Pelee, especially that on the 8th, when St. Pierre was destroyed.

Mr. E. H. Hobbs, Observer in charge at Basseterre, St. Kitts, forwards traces from the Richard barograph, and reports as follows:

The copies of the barograph traces fail to show the smaller fluctuations that are visible on the originals. There have been numerous squalls throughout the month and each has left its trace on the barograph record, but besides these there are many variations that were the effect of the volcanic explosions. Many more explosions were heard in the mountains than were noticed in town, but the actual times are unobtainable, owing to variations in the local clocks.

On the 7th I noticed several slight tremors but attributed them to the moving of goods in the store below and took no especial notice of them until I was told of the explosions heard in the mountains and in the other islands. They were not like our usual earthquake shocks, which are vibratory and last for several seconds, but were short and more like a sudden jar. These occurred at the time the cables were broken.

On the 8th similar noises, but not so loud and without the tremors, were heard in the early morning and were described as the discharge of distant cannon.

On the nights of these two days, the tops of thunder heads were seen far to the southeast and south and the reflection of distant lightning was observed; since that time the southern horizon has been too obscure to see the reflections farther away than thunder could be heard. Every day some persons have claimed they heard explosions, while others have said that it was a thunderstorm, so that it is impossible to separate the two phenomena.

On the 7th and 8th I made special inquiry and observations of my own in regard to a tidal wave or a change in level of the sea, but none was observed and I am positive there was none on this side of the island, and none was reported from the other side. The sea was comparatively

[1] The Weather Bureau observers invariably employ seventy-fifth meridian time in recording their own observations, but local times are given in these remarks as quoted from other sources.

smooth at the time and any change would have been quickly noticed.

The wind has been light most of the month. In the upper strata it has varied between west-southwest and northwest, when observed, so that very little smoke or dust has been visible in the upper atmosphere, the most of it being carried to the eastward. In the lower strata the winds have been very variable. They were about east for two days following the explosion, but beyond a murkiness of the southern horizon nothing was observed until the night of the 11th and on the 12th, when the wind shifted to the southeast and a slight smokiness was seen in all directions. It was very thin and scarcely perceptible except through long distances, and then only in the lower atmosphere. On the 13th and 14th the wind shifted to the southwest and the smoke became denser. It seemed to cause huge cumuli to form but instead of producing rain they would break up into fragments and disperse as they advanced farther northward.

On the 17th the wind shifted back to the east and northeast and a bluish colored haze or smoke was seen, entirely different in appearance from that hitherto observed, and on the afternoon of the 17th, some time before sunset, the sky became a brilliant yellow, so bright at times as to be painful to the eyes; since the 17th there have been frequent showers and very little, if any, haze or smoke, with the exception of the evening of the 24th, when the moon was observed to shine with a sickly greenish yellow light, the circle of light around it shading away to a reddish brown.

On the 19th the pumice was first observed on the northeast and east coast of this island, and on the 20th the driftwood made its appearance.

On the 20th, at 4:56, 4:57, and 5:56 a. m., three loud and distinct reports were heard; these were much louder than any that had occurred before and caused much uneasiness among the people. (The time given is seventy-fifth meridian.)

People living on the mountain estates report having heard the reports the night before, and in some instances during the entire night; the reports were accompanied by shocks in many places and were strong enough to rattle the sheet-iron roofing on verandas.

No disturbance of the sea discernible to ordinary observation accompanied these detonations.

On the 22d the heaviest thunderstorm in many years occurred shortly after noon. It started in the northeast, circled around the island and went back into the east. During the height of the storm a small tornado destroyed three thatched huts and stirred up a rough sea on the northern side of the island; no persons were injured or further damage reported.

On the 24th the moon was seen shining through smoke or dust in the eastern horizon; since that time the sky has been almost wholly overcast with clouds.

The 25th was a stormy day, with rain and high wind. On the night of the 25th and the early morning of the 26th heavy rains were reported from Nevis. A considerable amount fell here, 8.86 inches being reported at one estate and between 10 and 11 inches at another in the space of three and a half hours. Much damage is reported to the roads and waterworks.

On the 26th the day was cloudy and rainy with southerly winds, and the entire coast was lined with drifting wood, cane tops and canes, and rubbish of all descriptions, from Martinique.

On the 27th no rain fell during the day and the clouds were a little thinner and gave a glimpse of the sun now and then; this kind of weather is almost unknown in this locality. The sunset on this day was the first that showed the effects of the dust and smoke in the upper air, the sky being of a red color which lasted long after sunset and had the appearance of a distant fire.

The humidity has been and is still unusually high. No upper clouds have been seen above the alto-stratus since the 22d; those observed, usually alto-cumulus, were moving slowly from the west.

On June 6 the loudest explosion thus far was heard at 9:42 a. m. It was reported as occurring at 10:15 a. m. by the royal mail steamer *S. Alden*, which was leaving Fort de France at the time. The barograph trace shows the wave effect quite distinctly, as well as another about an hour before. Many explosions were reported from different localities, the greatest number, 34, by a person in Nevis. They were most numerous between the hours of 5 and 6 and 10 and 11 a. m.

On June 7 the haze was so dense as to entirely obscure the island of Nevis, 13 miles distant. Captain Cary, of the steamship *Korona*, reports light blue haze visible at St. Thomas, and the island of St. Kitts entirely obscured this morning until within 3 miles of land.

On June 8 the haze was dense, but appeared to be decreasing in the lower atmosphere. What seemed to be volcanic dust from Martinique was found deposited on the sunshine recorder this morning. It probably came down with the rain last night.

In the Jamaica weather report, No. 280, May, 1902, Mr. Maxwell Hall states:

The dust haze from the volcanoes in Martinique and St. Vincent was first noticed on the 7th, it was strong on the 10th and strongest on the 16th. It seems to have traveled with the trade winds at the rate of 12 or 13 miles an hour. The dust which fell on Barbados was carried there by the upper atmospheric current, which is from west to east.

Mr. H. H. Cousins, recently appointed as government meteorologist for Jamaica, adds to the above statement:

A small sample of dust collected at Hanbury, Shooter's Hill, Jamaica, was compared with a sample of dust sent from Barbados and found to be identical therewith in composition. The particles of the Jamaica dust were finer in grade.

Volcanic dust has been reported from other places as follows:

May 7.—Capt. D. Edwards, of the steamship *Louisiana*, left Barbados for Trinidad at 5:30 p. m. He says: "We steamed through this rain of dust for a distance of 90 miles, and at a low estimate one inch of it fell on the decks."

May 8.—Latitude 11° 21′ north, longitude 57° 47′ west (Martinique northwest 300 miles, St. Vincent west-northwest 250 miles), Capt. T. Thomas, of the steamship *Coya*, reports a fall of dust that was thickest from midnight of the 7th to a. m. of the 8th, with absolute darkness at 1:30 a. m.

May 8.—Captain Dennison, barque *Buchwood*, reports that at noon, in latitude 13° 22′ north, longitude 49° 50′ west (Mount Pelee west by north 660 miles), a fall of dust commenced, which continued until noon of the 9th, in latitude 14° 46′ north, longitude 51° 27′ west (Mount Pelee west 540 miles).

May 8.—Captain Corbett, of the barque *Eleanor M. Williams*, reports a very heavy fall of ashes from 3 to 8 p. m. in latitude 14° north, longitude 51° west (Martinique 250 miles west).

May 11–12.—Latitude 10° 32′ north to 12° 8′ north, longitude 52° 26′ west to 55° 56′ west, Capt. J. W. Slater, of the barque *Kings County*, reports the water discolored, probably by volcanic dust.

Capt. J. W. Curtis, barque *Ethel Boynton*, Philadelphia to Cartagena, May 11–June 2, reports the water discolored from the Mono Passage (Martinique east-southeast 400 mtles) southward to latitude 15° north and carrying particles which appeared to be volcanic ashes.

June 7.—After a severe thunderstorm that occurred during the previous night, ashes were swept from the upper deck of the steamer *Porto Rico*, at anchor near Ponce, Porto Rico. These ashes are thought to have come from an eruption on June 6 of Mont Pelee, 325 miles to the southward.

For some of the above items we are indebted to the National Geographic Magazine, July, 1902.

Afterglows appear to have been observed as follows: Bridgetown, Barbados, and Basseterre, St. Kitts, as already noted, and in the Hawaiian Islands, as recorded by Mr. Curtis J. Lyons on page 260 of this current REVIEW. In a letter dated May 26, 1902, Mr. Lyons adds the following:

The full moon also showed the effect of the upper haze in its feeble light. By day the lavender-gray haze is visible around the sun, with a radius of about 30°, the rest of the sky being blue, and no haze resting on terrestrial objects, showing the great elevation of the smoke layer or dust layer.

From the 10th to the 12th I had already noticed a gray haze and recorded it, but we had heard nothing of the eruption and no red afterglow was seen.

Capt. J. W. Salter reports that he first noted a peculiar red appearance of the sky on May 9, latitude 7° 26′ north; longitude 43° 51′ west, that increased each day until he reached Barbados on the morning of May 14.

Santiago de Cuba, A. V. Randall, Observer, United States Weather Bureau:

On May 13 and 16 the atmosphere was slightly hazy; during the evening twilight of May 24 and 25 and also of June 13 and 14 the sky and clouds were of a decidedly pink color, particularly in the west.

Havana, Cuba, W. B. Stockman, Forecast Official:

At Havana on the evening of June 9 there was (during the early evening) a fringe of strato-cumulus along the horizon and at a slightly greater altitude a circle of alto-stratus. At about 7:30 p. m. the alto-stratus began to assume a bright copper color, which at 8:05 p. m. became very brilliant; after the latter hour the glow decreased and the color of the clouds became normal about 8:30 p. m. The most brilliant color was noticed in the west, while the east, north, and south, respectively, were next in point of brilliancy. The glow was noticed only on the alto-stratus; the strato-cumulus along the horizon appearing normal throughout the evening. It is believed this was due to volcanic ashes.

Mr. E. H. Plumacher, United States Consul, Maracaibo, Vene-

zuela, under date of June 30, 1902, wrote regarding the unusual appearance of the sky at sunrise and sunset since the Mount Pelee eruption, the sky near the horizon being colored red, and the sun having a greenish hue. Also during the day, and especially in the forenoon, a large ring of prismatic colors surrounded the sun; and the heavens, which should be deep blue, showed a steel-gray color.

In Nature, for July 3, 1902, W. J. S. Lockyer refers to the afterglows observed at the Solar Physics Observatory, South Kensington, London, England, on June 22, 26, 27, 28, and 29, and at Bombay, India, on about the same dates.

These are by no means all the reports of the afterglows that have reached us. An especially brilliant one is reported to have been observed at Los Angeles on June 22 and 23 and a less brilliant one at Miami, Fla., on May 23, by P. H. Ralfs, Plant Pathologist, Department of Agriculture. All the above reports must, however, be received with caution, since brilliant sunsets often occur that have no connection with volcanic eruptions.—*H. H. K.*

NOISES ATTENDING THE ERUPTION OF MOUNT PELEE.

The eruption of Mount Pelee on Martinique, latitude 14° 45′ north, longitude 61° 10′ west, appears to have been heard as far away as Maracaibo, Venezuela, latitude 10° 45′ north, longitude, 71° 45′ west, a distance of about 12° of a great circle, or 830 English miles. In a report from E. H. Plumacher, United States Consul at Maracaibo, after some remarks on the weather that have, of course, no relation to the earthquake, he says:

> On the morning of the great calamity that has fallen upon the island of Martinique, strong rumbling sounds were heard here, as well as in the other parts of this state. At many places during the day before the catastrophe noises of heavy cannonading were heard at La Ceiba, Cabimas, Perija, and Quisiro. At Sinamaica the people thought that a great battle with heavy artillery was in progress near Maracaibo. * * * This is very natural when we keep in view our revolutionary tendencies.
>
> Early in the morning of the catastrophe I found that my servant had saddled my horse; when I asked him if somebody was sick and needed a doctor, he answered that he thought I needed my horse to go to the city, as a big battle must be going on, judging from the sounds of the heavy firing of guns. Observing the same sounds, I knew at once that it could not be heavy artillery, for if all of the cannons of Venezuela were fired together they could not produce such sounds.
>
> It was not like cannonading with heavy siege guns; it was neither thunder nor the strange unpleasant subterranean sounds of convulsions of the earth; it was as if immense explosives were fired high up in the clouds. * * * Last night (May 12) after eleven o'clock we had a slight horizontal trembling movement from a southwesterly direction.—*C. A.*

DUST STORM AND MUD SHOWER.

Several communications have been sent us respecting a shower of discolored rain that fell in a number of the Middle Atlantic States on April 13. An area of low barometer accompanied by thunderstorms crossed the Great Lakes to the Atlantic coast during the night of the 12th, and was followed by a high area, giving heavy winds. The following extracts indicate that vast quantities of dust must have been taken up by the wind on the dry western plains, and that it was precipitated with the rain over the States farther east.

From the Republican, Belvedere, Ill., April 12, 1902:

> A dust storm in the middle of April is almost an unheard of thing, and laying aside the fact that yesterday's (April 11) deluge of dirt came in a month when the earth should be saturated with moisture, it was remarkable for being the worst dust storm in this section at any season for some years. The most recent approach to this storm was about six years ago when red dust was brought from the western plains by a high wind and deposited on the snow, giving it a sinister dark blood-like appearance.
>
> The unprecedented dry weather had prepared the earth for the visitation of the wind yesterday and when the strong gale set in from the west it picked up the dust and particles of debris in clouds and whirled it through the air.
>
> The clouds of dust were carried high in the air and hung like a pall over everything. The sun was almost completely obscured. Casual observers thought that the sky was cloudy and that there was a possibility of rain, but closer observation revealed the fact that what seemed to be murky, low-hanging clouds was in reality a veil of dust hanging between heaven and earth. Along toward evening the setting sun reddened this cloud and gave it the appearance of coming from a distant fire.

Rev. Robert C. Caswell writes from Stroudsburg, Pa., as follows:

> On Friday afternoon, April 11, about 4 o'clock, very black clouds gathered in the southwest, and passed on eastward, but there was only a very slight sprinkle of rain. The next morning, Saturday, the air was filled with what seemed like smoke; but considering the great rains we had had all the week we were certain the woods were not on fire. The air got thickest about 12 or 1 o'clock, when it resumed its normal clearness. There was a slight sprinkle of rain about the middle of the day, lasting only five minutes, but the rain instead of being clear was muddy. My friend, Mr. W. H. Truslow, who lives just outside South Stroudsburg says that the new sails of his sailing canoe which he had just hoisted for the first time were sprinkled all over with thin mud, as also were the windows of his house (southern aspect).

Mr. J. H. Jewett, Canandaigua, Ontario County, N. Y., sends a sample of white cotton cloth that was spotted by the shower at that place. It has much the appearance of having been mildewed.

Rev. Geo. P. Sewall writes from Aurora, Cayuga County, N. Y., as follows:

> Last Saturday, April 12, a strange phenomenon was witnessed in a remarkable shower sweeping from the west and extending the entire length of the lake (Cayuga), 40 miles. How much farther it may have reached I do not know, but I have waited to glean positive testimony before writing you to ask if you can give any satisfactory explanation.
>
> All Saturday forenoon the air was very calm, but a strange ashy-looking, very dense mist hung over the lake. The atmosphere was heavily charged with moisture, but no rain fell until noon, when a sudden downpour dashed upon us from clouds which were so dense as to throw a pall of darkness over everything. Some say the light over the lake was of a pinkish color. To me it was more the hue of the sand dunes of Michigan City. Once having passed us the cloud filled the eastern sky with inky blackness. So threatening was the appearance of the sky upon the approach of the shower that many feared a veritable cyclone [tornado]. At this point, however, the wind was not severe, nor was it destructive in this vicinity, so far as I can learn. The shower once upon us, it was discovered to be surcharged with sand, or mud, which discolored or soiled everything exposed to it. Our windows were besmeared with muddy water; ridges of light colored sand lay along our tin roofs when the moisture dried away; on my veranda floor before the water evaporated the deposit had the appearance of coal dust or finest black mud; towels and coverlids on the grass bleaching had to be rewashed, they were so thoroughly soiled; in Ithaca umbrellas caught in the shower looked as if they had been trailed in the mud, and farmers in the fields or on the roads in Aurelius, north of us, say they could feel the sand on their faces. Careful examination with a strong microscope showed the deposit to be composed of minute particles of various shapes, some like the tiny grains of wheat, mustard seed, or tiny cylinders, while others were brilliant transparent crystals, no two of which were alike in shape, but looked like mica or flakes of quartz. No one here had ever before witnessed such a phenomenon, and all wonder whether some terrific cyclone prevailed west of us to carry up such volumes of dust and bring them great distances to thus hurl them down here over so wide an area.

From newspaper clippings we learn that the mud rain was observed at Smithfield and Middle Smithfield, Pa., at the Delaware Water Gap, and at towns along the Hudson from Elizabeth, N. J., northward to Newburg and Poughkeepsie, N. Y.; and from Science, for May 30, 1902, p. 872, that it was also observed at Easton Pa., and New Haven Conn.—*H. H. K.*

SCIENCE IN POETRY.

In venturing to publish a poem in the MONTHLY WEATHER REVIEW, the Editor owes it to himself and his readers to quote as justification the occasional practise of several other scientific journals which do not decline to publish contributions that are so eminently true to nature as is the present description of the general phenomena of a West Indian hurricane. Our correspondent, when living on the banks of the Hudson, read in the daily papers a telegram from Washington announcing the steady approach of the hurricane of September, 1897. It was while listening to the rush of the preliminary northeast winds

and under the influence of the somber skies, that the hurricane appeared to the author as the embodiment of a demon of destruction. These lines written under such circumstances will, perhaps, express the thoughts and feelings of many of our readers. The poetry is good; the meteorology seems to be correct, and therefore we can not refuse a place to these graphic lines.—*C. A.*

THE CYCLONE.

With my heart on fire
With the sun's desire
I arise from my tropic home,
And curl and swirl
With a passionate whirl
To the breast of the temperate zone;
Then my arms I fling
Round the winds and sing
As I fast and faster turn
In my sullen shroud
Of darkening cloud
Through which the lightnings burn.

Around and around
With terrible sound
A living wheel of air,
I circling glide
O'er the ocean's tide
And scatter the ships that are there;
Then close to the shore
I press on and roar
While towns and cities fall,
As my garments swing
In the fatal ring
I destroy them one and all.

And women and men
Proud as gods till then
By the fringe of my skirts are crushed;
With my eyes on high
I can see them die
Like ants by a besom brushed.
What are men to me?
Mere specks on the lea
To a great Elemental Power;
Their prayers are in vain
For naught can restrain
My impulse in that mad hour.

I laugh as I rest
On the waves' white crest
Lashed to foam by the touch of my feet,
As I strew the shore
With their wrecks evermore
Where the land and the waters meet.
I laugh as I crush
Through cities and rush
Over fields of ripening grain,
And I cut my way
Through the forests gray
With a howl of wild disdain.

No pity I show,
No mercy can know,
My course is relentlessly pressed;
Though the winds may howl
And the black waves scowl
And the seagull dash at my breast.
My path can be traced
By the life effaced
Wherever I chance to roam;
Destruction and death
Must follow my breath
From the gulf to the icebergs' home.

I am born of heat
Where earth's passions meet
In the languorous Carib Sea,
And by fate must go
To the land of snow
Where the lakes and mountains be.
On the north's cold breast
I am lulled to rest
By the pine trees' solemn moan;
There, my passion dead
And my spirit fled
I die unseen and alone.

Townsend Allen, in New York Tribune.

METEOROLOGICAL OBSERVATIONS BY TRAVELERS.

Those who are about starting on a journey, and sometimes those who are going to the country for the summer, often express an interest in meteorology and ask whether they can not keep records that would be of interest or value to the Weather Bureau. Instructions for the use of travelers have been published by several scientific organizations, and it has not yet been necessary for the Weather Bureau to duplicate these. It is only when the traveler goes beyond the confines of the numerous well organized meteorological systems that he feels that it devolves upon him to maintain a very complete meteorological record. In general, the record of such a traveler must have at least three different objects in view: (1) to contribute otherwise inaccessible data to the completion of each daily weather map; thus, whether he is at sea or on land, he may greatly extend our knowledge of the daily isobars or isotherms and the movements of high and low areas; if he is on a mountain top he may give us important information as to the upper air conditions. (2) If the traveler remains sufficiently long in one place he may give us mean values of pressure, temperature, rainfall, etc., that are valuable for the study of local climate. (3) There is a large class of special phenomena that is likely to interest the traveler and be of value to meteorology, such, for instance, as the maximum and minimum temperatures, the relative humidity, the movement of the clouds, the occurrence of gales, thunderstorms, auroras, the blue color of the sky, the transparency of the air, the number of particles of dust in the air, the polarization of skylight, the intensity of the heat received from the sun, earthquake motions, etc. If the traveler could always know his altitude above sea, as determined by the spirit level, then, the barometric reading would be desirable. After the traveler has returned, the problem of working up and publishing his results becomes important. Of course, we have before us the examples of the great exploring expeditions, whose volumes of reports give every detail of the work and most of the consequences that can be drawn from it; but for individuals and minor expeditions nothing so expensive can be contemplated. In the recent Harriman expedition to Alaska, we believe that the principal meteorological contribution was by Professor Brewer of Yale in his chapter on the general character of the Alaskan atmosphere. This voyage afforded an almost unique opportunity to observe the directions of motions of the upper clouds in northern latitudes, a matter that, at present, is considered of the highest importance; the observations can easily be made at sea or on land by means of the marine nephoscope. The meteorology of the first Wellman expedition to Spitzbergen is now in the Editor's hands, and will, we hope, appear in the MONTHLY WEATHER REVIEW. The record of a geological expedition, in 1900, to Labrador, by Professors Daly, of Harvard University, and Delabarre, of Brown University, has recently been published by the Geographical Society of Philadelphia. This trip along the coast of Labrador had a special interest to the Editor, because he was so fortunate some years ago as to come into possession of the original manuscript record kept at the old Moravian stations Nain and Okkak during the years 1774–1786 with instruments that had been carefully constructed in England. During the past ten years the German Government has adopted these stations as a part of its own system and their records are now published regularly.

The Brown-Harvard expedition to Labrador, occupied the months of July, August, and September, 1900, with a few days before and after. The published record gives a general summary of winds, temperature, moisture, and pressure. There were about forty-two sailing days and fifty-two days of detention, of which nine were due to the ice. There were 40 per cent of southerly winds; 27 per cent of northerly; 14 per cent of calms; six days of continuous rain; thirty-eight days of fog.

Among the precautions that must always be considered by travelers is the general consideration that the temperature of the air can not possibly be determined satisfactorily except by using either the aspirated psychrometer of Assmann or the portable sling psychrometer; the latter was, we believe, first used by de Saussure and Espy, and is now frequently recommended by the Weather Bureau when the whirled psychrometer in a permanent thermometer shelter is not available. In fact, by using the sling psychrometer, first in the shade, and, then, immediately afterwards in the sunshine, we always have a good check on the accuracy of our work.

It is greatly to be hoped that the wealthy owners of steam yachts and sailing yachts will sometimes consider within themselves whether they can not provide accommodations for a meteorological observer and thus make it possible for us to investigate the motions of the winds and clouds, and other important phenomena on the ocean, where good observations are so rare and so greatly needed.—*C. A.*

BACK NUMBERS OF THE MONTHLY WEATHER REVIEW.

Owing to the increased demand for special numbers of the MONTHLY WRATHER REVIEW the Editor would again call attention to the fact that those who do not need to retain their copies will confer a favor by sending word to that effect, whereupon penalty envelopes will be furnished to facilitate their return.

THE WEATHER OF THE MONTH.

By W. B. STOCKMAN, Forecast Official, in charge of Division of Records and Meteorological Data.

CHARACTERISTICS OF THE WEATHER FOR MAY.

On the coast of central and northern California, and over the United States east of the ninety-fifth meridian, except in the extreme western parts of Louisiana and Arkansas and the extreme eastern part of Texas, the pressure was above the normal; elsewhere in the United States it was below the normal, and from northeastern Florida northwestward over eastern Minnesota, and northeastward over Maryland it had increased over that of the preceding month.

From central and western Nebraska southward over north-central and western Texas and New Mexico, in the lower Ohio Valley, northeastern Iowa, northwestern North Dakota and southwestern Wisconsin the precipitation ranged from 2 inches to 7 inches above the normal, while in the districts showing a deficiency in precipitation the departures were not nearly so great.

From northeastern Ohio eastward and northeastward to the Atlantic coast, west of the one hundred and fifteenth meridian, except in western Washington and on the northwestern coast of California, and in western Arizona the temperature was below the normal; elsewhere it was above the normal, and generally markedly so; and, as a rule, the isotherm of maximum temperatures of 90° or higher trends considerably to the north of where it lay in May, 1901.

The occurrence of winds of 50 miles or more per hour was considerably above the average, and was three times greater than that of May, 1901.

The number of thunderstorms during the month was remarkable, being greater than any May since the date of beginning of record in 1894.

PRESSURE.

The distribution of monthly mean pressure is shown graphically on Chart IV and the numerical values are given in Tables I and VI.

The area of relatively high pressure, which was 30 inches or slightly higher, extended from the Great Lakes southward to the Gulf of Mexico and southern Florida and southeastward over the Atlantic coast. Another, but smaller, area overlay the immediate coast of Oregon and northern and central California. Over the greater portion of the first area the departures from the mean amounted to between +0.05 inch and +0.08 inch, while over the second area they were somewhat less.

From eastern Minnesota southeastward and eastward over northeastern Florida, the Atlantic coast States and New England the pressure increased considerably over April, 1902. In the lower Lake region and the northeastern part of the upper Lake region the changes ranged from +0.10 inch to +0.13 inch. Over the other districts of the United States the pressure was lower than during the preceding month, and the greatest changes, −0.10 inch to −0.16 inch, occurred in the upper Missouri Valley and the northern Slope regions.

TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperature, as deduced from the records of about 1,000 stations, is shown on Chart VI.

Over almost the entire United States the mean temperature for the month was above the normal, the only districts where it was below the normal being west of the one hundred and fifteenth meridian and in western Arizona, northeastern Ohio, northern Pennsylvania, New York, and New England. From the northern part of the west Gulf States and the western parts of the Carolinas and West Virginia northwestward over Kansas, Nebraska, and South Dakota the departures ranged from +4° to +8°. In the interior of central and northern California and in central Oregon the departures amounted to from −2° to −4°.

The average temperature for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	53.1	−0.4	+8.4	+1.7
Middle Atlantic	12	62.0	+0.4	−0.8	−0.2
South Atlantic	10	72.9	+2.6	−8.7	−1.7
Florida Peninsula	8	78.2	+2.3	−6.0	−1.2
East Gulf	9	76.6	+4.0	−6.6	−1.3
West Gulf	7	76.0	+3.4	+0.8	+0.2
Ohio Valley and Tennessee	11	69.1	+3.9	−5.6	−1.1
Lower Lake	8	56.6	−0.2	+3.3	+0.7
Upper Lake	10	53.0	+1.6	+15.7	+3.1
North Dakota	8	56.8	+3.5	+22.1	+4.4
Upper Mississippi Valley	11	65.8	+4.4	+7.6	+1.5
Missouri Valley	11	65.4	+5.3	+12.3	+2.5
Northern Slope	7	56.6	+3.1	+14.9	+3.0
Middle Slope	6	66.1	+4.1	+8.6	+1.7
Southern Slope	6	70.7	+1.7	+5.7	+1.1
Southern Plateau	13	63.0	−1.5	+0.6	+0.1
Middle Plateau	9	55.2	−0.8	+4.9	+1.0
Northern Plateau	12	54.2	−0.7	+6.8	+1.4
North Pacific	7	54.1	−0.3	+2.5	+0.5
Middle Pacific	5	56.9	−1.5	−2.6	−0.5
South Pacific	4	60.8	−1.5	−2.2	−0.4

Except on the immediate coasts of northern California, Oregon, and Washington, and in a few scattered localities in other sections of the United States, maximum temperatures of 80° or

higher everywhere occurred. The isotherm of 90° extended generally as far north as the fortieth parallel, except in portions of the Appalachian and southern and middle Slope regions. Maximum temperatures of 90° or higher also occurred in the central part of northern California, central Oregon, south-central Washington, and generally in southwestern Idaho. Maximum temperatures of 100° or higher were reported from south-central Texas, western Arizona, and southeastern California.

Minimum temperatures of 32° or lower occurred in New England, New York, except the extreme southeastern part, northern and south-central Pennsylvania, Michigan, except the southeastern part, the northern parts of Wisconsin and Minnesota, and generally throughout the Rocky Mountain regions.

In Canada.—Prof. R. F. Stupart says:

The temperature was from average to 1° above in the western and central portions of the Lake region, from 1° to 2° above in Assiniboia and Saskatchewan, 4° above in Manitoba, and elsewhere over the large remaining portion of the Dominion it was from average to 2° below.

PRECIPITATION.

In northern New England, the lower Ohio Valley, western Tennessee, southern and western parts of the upper Lake region, upper Mississippi Valley, North Dakota, northern part of the northern slope, from Nebraska and southeastern Wyoming southward, on the west coast of southern Florida, and in scattered parts of the middle and north Pacific regions the precipitation was above the normal, the excess amounting to between 6 and 7 inches over south-central Kansas, Oklahoma, and the panhandle of Texas and from 4 to 6 inches in south-central Nebraska, parts of central Kansas, southwestern Wisconsin, and northeastern Iowa; elsewhere in the region of excess of precipitation the departures were not so large.

In Massachusetts, southeastern New York, eastern Pennsylvania, northeastern Maryland, the eastern part of the Carolinas, northeastern and extreme southern Florida, the central parts of Illinois and Ohio, southern Mississippi, southeastern Louisiana, northeastern Texas, northwestern Arkansas, southeastern South Dakota, and northwestern Iowa the deficiency ranged from 2 inches to somewhat over 4 inches. In the remaining districts the excess or deficiency amounted to less than two inches.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	1.86	52	−1.7	−0.8
Middle Atlantic	12	2.07	56	−1.6	−2.5
South Atlantic	10	2.38	60	−1.6	−5.6
Florida Peninsula	8	2.72	75	−0.9	−1.6
East Gulf	9	2.64	65	−1.4	−2.8
West Gulf	7	3.01	68	−1.4	−6.1
Ohio Valley and Tennessee	11	3.44	92	−0.3	−6.0
Lower Lake	8	3.21	94	−0.2	−3.5
Upper Lake	10	3.77	115	+0.5	−2.2
North Dakota	8	3.69	161	+1.4	+1.9
Upper Mississippi Valley	11	4.53	107	+0.3	−1.9
Missouri Valley	11	2.89	72	−1.1	−3.3
Northern Slope	7	3.70	161	+1.4	+0.6
Middle Slope	6	6.42	177	+2.8	+1.2
Southern Slope	6	8.88	218	+4.8	+4.0
Southern Plateau	13	0.69	117	+0.1	−1.1
Middle Plateau	8	0.35	37	−0.6	−0.7
Northern Plateau	12	2.53	131	+0.6	−0.2
North Pacific	7	2.72	93	−0.2	+3.3
Middle Pacific	5	1.32	87	−0.2	+1.9
South Pacific	4	0.03	7	−0.4	−0.5

In Canada.—Professor Stupart says:

Precipitation was everywhere above the average, except over the greater portion of the Peninsula of Ontario and the eastern portion of the Province of Ontario, as well as in the southern and eastern parts of the Maritime Provinces. The excess was very considerable from British Columbia to Manitoba and also in Quebec. Many parts of the Northwest Territories suffered greatly from freshets and the total precipitation of the month recorded at Calgary and Edmonton, namely 8.9 inches and 7.7 inches, being 7.1 and 6.1 inches above the average, respectively, is a most phenomenal occurrence in a province which has such a small mean annual precipitation. In Assiniboia and Saskatchewan the precipitation was also very excessive, while in Manitoba it was from 1 to nearly 2 inches above the average, and in Quebec from nearly 1 inch to 2½ inches above. In Ontario the distribution of the rainfall was rather varied; over the Georgian Bay district and northern localities it was above the average locally to a considerable amount; over the extreme southwestern portion it was also above, whereas many interior and eastern localities showed a deficiency of from 1 to nearly 2 inches. The deficiencies in the Maritime Provinces varied from a half to over an inch.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 4, 21, 31. Arizona, 18, 19. Arkansas, 19, 22. California, 1, 2, 4, 13, 14, 18, 25, 31. Colorado, 3, 4, 5, 8, 10, 11, 12, 13, 14, 15, 18, 19, 20, 22, 24, 25, 26, 27, 28, 29, 30. Delaware, 26. Florida, 2, 3, 30. Georgia, 1, 5, 9, 12. Idaho, 1, 2, 3, 4, 14, 17, 18, 31. Illinois, 1, 2, 3, 4, 5, 6, 17, 18, 20, 21, 22, 23, 24. Indiana, 4, 10, 13, 14, 20, 22, 23, 24, 25, 26. Indian Territory, 4, 18. Iowa, 1, 2, 3, 4, 9, 10, 12, 13, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 29. Kansas, 1, 2, 4, 13, 19, 20, 21, 24, 25, 31. Kentucky, 2, 10, 13, 20, 23, 24, 25. Louisiana, 15, 19, 31. Maine, 2, 4, 8, 23, 28. Maryland, 3, 7, 20, 25. Massachusetts, 25. Michigan, 3, 5, 6, 8, 19, 22, 26. Minnesota, 1, 3, 6, 9, 17, 19, 20, 21, 23, 24. Mississippi, 16. Missouri, 1, 2, 4, 13, 14, 19, 21, 23, 24, 25. Montana, 1, 16, 24, 26, 27, 29, 31. Nebraska, 1, 2, 10, 13, 17, 18, 19, 20, 21, 22, 24, 25. Nevada, 1, 17, 20, 21, 24, 30. New Hampshire, 9. New Jersey, 23, 25, 26. New Mexico, 8, 12, 13, 14, 18, 19, 26, 27. New York, 4, 6, 9, 24, 28. North Carolina, 2, 4, 5, 6, 7, 11, 13, 21, 25. North Dakota, 9, 17, 18, 19, 20, 24. Ohio, 2, 4, 5, 6, 10, 11, 13, 20, 21, 22, 24, 25, 26. Oklahoma, 1, 18, 20, 21, 22, 25. Oregon, 1, 2, 10, 13, 16, 17, 18, 19, 27, 29. Pennsylvania, 2, 10, 23, 25. South Carolina, 3, 4, 14, 25. South Dakota, 1, 2, 3, 9, 17, 19, 23, 24, 31. Tennessee, 1, 3, 5, 12, 13, 14, 24, 26, 30. Texas, 1, 4, 6, 15, 16, 17, 18, 19, 22, 24, 27, 28, 30. Utah, 11, 12, 17, 18, 19, 20, 21. Virginia, 5, 6, 7, 8, 13, 19, 20, 22, 25. Washington, 1, 10, 12, 15, 16, 17, 18, 28, 29, 30. West Virginia, 2, 3, 5, 10, 13, 14, 19, 24, 25, 26. Wisconsin, 1, 2, 9, 10, 18, 20, 21, 24, 25. Wyoming, 1, 5, 8, 13, 15, 17, 28, 29, 30.

SLEET.

The following are the dates on which sleet fell in the respective States:

Colorado, 18, 31. Idaho, 17, 18. Maryland, 25, 28. Michigan, 5, 10, 25, 26. Minnesota, 1, 9. New Hampshire, 9. New Mexico, 12, 18, 19, 26. New York, 9, 28, 29. North Dakota, 9. Ohio, 10, 11. South Dakota, 9. Utah, 2, 4, 17, 18, 19, 20. Washington, 29. Wisconsin, 9, 10. Wyoming, 17.

HUMIDITY.

The average by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	72	− 6	Missouri Valley	69	+ 4
Middle Atlantic	69	− 2	Northern Slope	65	+ 8
South Atlantic	74	0	Middle Slope	68	+ 8
Florida Peninsula	73	− 4	Southern Slope	65	+ 7
East Gulf	72	0	Southern Plateau	31	+ 1
West Gulf	77	+ 4	Middle Plateau	42	− 3
Ohio Valley and Tennessee	68	0	Northern Plateau	61	+ 3
Lower Lake	70	0	North Pacific	76	− 2
Upper Lake	73	+ 1	Middle Pacific	71	− 1
North Dakota	74	+10	South Pacific	68	0
Upper Mississippi Valley	72	+ 5			

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the table below:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.4	— 0.1	Missouri Valley	5.2	— 0.2
Middle Atlantic	5.1	— 0.1	Northern Slope	5.2	— 0.2
South Atlantic	3.9	— 0.5	Middle Slope	5.4	+ 0.6
Florida Peninsula	4.3	— 0.2	Southern Slope	4.6	+ 0.1
East Gulf	4.7	+ 0.4	Southern Plateau	2.6	+ 0.4
West Gulf	5.2	+ 0.3	Middle Plateau	4.2	+ 0.1
Ohio Valley and Tennessee	4.8	— 0.3	Northern Plateau	6.3	+ 0.7
Lower Lake	4.9	— 0.3	North Pacific	7.2	+ 1.3
Upper Lake	5.9	+ 0.4	Middle Pacific	4.3	+ 0.1
North Dakota	5.0	— 0.3	South Pacific	3.6	— 0.6
Upper Mississippi Valley	5.5	+ 0.3			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 6,425 thunderstorms were received during the current month as against 2,479 in 1901 and 2,404 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 24th, 478; 25th, 412; 23d, 368.

Reports were most numerous from: Illinois, 428; Missouri, 426; Ohio, 372; Iowa, 370.

A remarkable number of thunderstorms occurred in May, 1902, as shown by the following numbers recorded for each May during the period 1894 to 1902: 1894, number of thunderstorms reported, 3,657; 1895, 2,969; 1896, 4,795; 1897, 3,001; 1898, 4,545; 1899, 5,305; 1900, 3,855; 1901, 2,479; 1902, 6,425.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 18th to 26th.

In Canada: Thunderstorms were reported as follows: St. John, New Brunswick, 23; Halifax, 24; Grand Manan, 8, 25; Yarmouth, 7; Quebec, 23; Montreal, 22, 23; Bissett, 22, 25, 26; Ottawa, 1, 9, 23, 24, 26; Kingston, 7, 23, 24; Toronto, 9, 22; White River, 19, 22, 23; Port Stanley, 2, 4, 6, 7, 19, 20, 22, 23, 25, 26; Parry Sound, 6, 8, 20, 24, 25; Port Arthur, 29; Winnipeg, 18; Minnedosa, 7, 18, 19, 20, 21; Qu'Appelle, 6, 17, 18, 20, 29; Medicine Hat, 10, 15, 29; Swift Current, 19, 23, 30; Banff, 15; Battleford, 5, 28; Kamloops, 13; New Westminster, 27; Barkerville, 9, 10, 22, 27.

Auroras were reported as follows: White River, 29; Minnedosa, 9, 30.

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	17	53	w.	Mount Tamalpais, Cal	17	75	nw.
Do	21	56	sw.	Do	18	69	nw.
Bismarck, N. Dak	19	50	se.	Do	19	69	nw.
Buffalo, N. Y	8	50	sw.	Do	26	62	nw.
Do	22	50	w.	Do	28	56	nw.
Chicago, Ill	10	53	se.	Do	29	76	nw.
Do	25	54	ne.	Do	30	60	nw.
Cleveland, Ohio	4	58	w.	Do	31	52	nw.
Do	19	50	n.	New York, N. Y	9	64	nw.
Do	22	50	w.	Point Reyes Light, Cal	2	55	nw.
Denver, Colo	1	68	nw.	Do	16	76	nw.
Dodge, Kans	17	53	se.	Do	17	90	nw.
El Paso, Tex	18	50	sw.	Do	18	110	nw.
Fort Smith, Ark	18	50	sw.	Do	19	75	nw.
Huron, S. Dak	1	51	se.	Do	20	57	nw.
Minneapolis, Minn	1	50	se.	Do	29	66	nw.
Moorhead, Minn	1	52	se.	Do	30	65	nw.
Mount Tamalpais, Cal	7	50	nw.	Do	31	62	nw.
Do	8	59	nw.	St. Louis, Mo	4	52	sw.
Do	11	50	nw.	San Antonio, Tex	18	65	w.
Do	16	86	nw.	Sioux City, Iowa	20	50	s.

DESCRIPTION OF TABLES AND CHARTS.

By W. B. STOCKMAN, Forecast Official, in charge of Divison of Records and Meteorological Data.

For description of tables and charts see page 570 of REVIEW for December, 1901.

TABLE I.—*Climatological data for Weather Bureau Stations, May, 1902.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.									Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.							53.1	— 0.4										72	1.86	— 1.7								5.4	
Eastport	76	69	74	29.86	29.94	— .02	47.8	+ 0.3	84	23	56	31	10	40	38	42	38	75	3.85	+ 0.2	17	7,693	sw.	32	sw.	9	8	8	15	6.7	
Portland, Me.	103	81	117	29.82	29.94	— .03	52.6	— 1.0	89	23	61	30	10	44	31	47	40	66	2.17	— 1.4	11	7,095	s.	40	w.	9	15	4	12	5.0	
Northfield	876	15	65	29.03	29.98	+ .01	50.9	— 2.8	84	22	62	22	10	39	50	46	41	70	3.42	+ 0.6	13	7,136	n.	36	n.	10	5	11	15	6.7	T.
Boston	125	115	181	29.84	29.97	— .01	57.8	+ 1.3	88	23	67	34	10	49	30	51	45	66	1.07	— 2.5	8	8,368	sw.	38	w.	9	11	11	9	5.3	
Nantucket	12	43	85	29.99	30.01	+ .02	51.9	— 0.6	65	27	57	39	10	47	16	48	45	81	0.74	— 2.8	10	10,446	sw.	42	nw.	9	7	15	9	6.1	
Block Island	26	11	70	29.97	30.00	+ .01	52.6	+ 0.2	66	26	58	37	10	47	18	49	46	82	1.04	— 2.7	10	12,303	sw.	46	n?.	9	10	15	6	4.5	
Narragansett		10					53.9	— 0.7	71	8	62	34	10	46	26				1.01	— 3.0	10		sw.				22	1	8		
New Haven	106	117	140	29.88	29.99	.00	57.5	— 0.1	85	23	67	36	10	48	29	51	44	65	1.61	— 2.0	9	6,848	sw.	36	nw.	9	19	4	8	3.8	
Mid. Atlantic States.							62.0	— 0.4										69	2.07	— 1.6								5.1	
Albany	97	102	115	29.89	30.00	+ .02	57.0	— 2.3	90	23	67	30	10	47	33	50	43	62	1.91	— 1.3	9	6,107	s.	33	w.	9	11	10	10	5.5	T.
Binghamton	875	79	90	29.08	30.02	+ .04	55.0	— 1.8	86	23	66	29	10	44	37				1.93	— 2.2	14	4,764	nw.	25	nw.	9	7	15	9	5.8	T.
New York	314	108	350	29.67	30.00	+ .01	60.2	+ 0.7	88	23	68	38	10	52	28	52	46	64	1.23	— 2.0	8	9,329	nw.	64	nw.	9	11	11	9	5.1	
Harrisburg	374	94	104	29.64	30.04	+ .06	62.0	+ 1.8	89	23	72	40	10	52	34				0.29	— 4.4	7	5,547	w.	37	w.	25	9	13	9	5.7	
Philadelphia	117	168	184	29.91	30.03	+ .04	62.6	+ 0.6	90	23	72	40	10	53	29	54	48	63	2.01	— 1.2	6	7,874	sw.	28	nw.	9	13	7	11	5.0	
Scranton	805	111	119	29.16	30.02	+ .04	58.3	.....	89	23	69	32	10	48	36	50	43	60	1.61	.....	10	5,901	sw.	30	nw.	9	9	15	7	5.4	
Atlantic City	52	39	48	29.98	30.04	+ .06	57.6	+ 0.4	82	7	64	42	10	52	28	54	52	84	1.71	— 1.1	9	6,354	sw.	24	nw.	9	14	14	3	4.2	
Cape May	17	47	51	30.04	30.06	+ .07	58.8	+ 0.2	80	7	65	42	10	53	26	54	....	....	2.13	— 1.0	9	5,727	s.	24	nw.	9	13	13	5	4.6	
Baltimore	123	68	82	29.89	30.02	+ .03	64.6	+ 0.4	90	23	74	43	10	55	33	56	51	66	1.62	— 2.2	8	5,932	sw.	32	w.	28	9	9	13	5.6	
Washington	112	59	76	29.92	30.04	+ .04	65.4	+ 1.5	90	23	76	41	10	54	34	58	54	73	3.35	— 0.6	11	4,992	s.	34	nw.	25	13	14	4	4.3	
Cape Henry		5	58				65.6	+ 1.1	92	7	74	49	11	57	39				3.26	— 0.8	11	9,933	se.	45	n.	13	8	11	12	5.7	
Lynchburg	681	83	88	29.30	30.03	+ .03	68.2	+ 2.2	94	5	80	42	29	57	39	60	54	66	2.27	— 1.6	11	3,369	sw.	40	nw.	2	7	19	5	5.2	
Norfolk	91	102	111	29.95	30.05	+ .05	66.6	+ 0.2	90	13	76	50	11	57	38	61	58	80	3.16	— 1.1	11	7,050	s.	44	nw.	25	18	8	5	3.8	
Richmond	144	82	90	29.90	30.05	+ .06	67.8	.....	91	13	79	46	28	57	37	....	....	....	3.42	.....	12	4,261	sw.	20	sw.	19	10	12	9	5.1	
S. Atlantic States.							72.9	+ 2.6										74	2.38	— 1.0								3.9	
Charlotte	773	68	76	29.22	30.04	+ .05	72.4	+ 4.0	94	3	83	48	28	62	28	63	58	69	3.39	— 1.0	9	4,633	sw.	32	nw.	25	15	10	6	4.0	
Hatteras	11	18	47	30.05	30.06	+ .05	68.2	+ 1.8	82	20	73	55	15	63	16	64	61	82	2.16	— 2.4	6	8,093	sw.	36	n.	27	13	13	5	4.4	
Kittyhawk	8	12	30				67.6	+ 1.6	88	7	76	53	*	59	30	....	....	....	1.24	— 2.5	3	9,592	sw.	....	....	....	21	6	4	3.5	
Raleigh	376	93	101	29.65	30.04	+ .05	70.7	+ 3.2	92	3	81	47	28	60	31	62	58	72	2.00	— 2.4	8	4,592	sw.	29	s.	6	15	13	3	4.1	
Wilmington	78	82	90	29.98	30.06	+ .05	71.0	+ 1.3	90	20	80	51	28	62	23	64	61	76	2.33	— 1.8	8	6,264	sw.	29	s.	25	11	17	3	4.2	
Charleston	48	14	92	30.01	30.05	+ .04	74.8	+ 2.4	94	20	81	59	28	68	25	68	66	79	1.43	— 2.6	6	7,985	s.	38	ne.	15	11	18	2	4.3	
Columbia	351	114	122	29.68	30.05	+ .05	74.2	+ 1.8	94	3	84	52	28	64	27	64	59	69	3.33	— 0.5	13	5,340	se.	44	sw.	1	12	16	3	4.7	
Augusta	180	89	97	29.84	30.03	+ .04	75.6	+ 3.6	95	20	86	57	28	65	29	66	62	68	3.54	+ 0.1	9	3,935	se.	42	nw.	1	17	11	3	3.5	
Savannah	65	79	89	29.98	30.05	+ .05	76.6	+ 3.7	96	4	85	63	30	68	26	69	67	82	2.51	— 0.4	10	5,644	sw.	30	ne.	1	18	11	2	3.1	
Jacksonville	43	69	84	29.97	30.02	+ .02	77.8	+ 2.9	93	26	86	64	1	69	24	69	66	73	1.82	— 2.2	8	5,353	se.	27	n.	9	16	14	1	3.2	
Florida Peninsula.							78.7	+ 1.6										73	3.07	— 0.6								4.3	
Jupiter	28	10	30	29.98	30.01	+ .03	77.8	+ 2.1	92	27	85	66	4	71	23	71	69	74	4.83	— 0.5	7	8,655	se.	48	nw.	27	10	20	1	4.0	
Key West	22	43	50	29.96	29.98	+ .01	80.0	+ 0.6	87	30	84	72	13	76	12	72	69	71	0.28	— 2.9	4	6,384	e.	26	ne.	31	16	13	2	3.7	
Tampa	34	60	67	29.97	30.00	+ .01	78.2	+ 2.2	92	30	88	64	23	68	28	70	67	75	4.11	+ 1.7	7	4,844	ne.	42	se.	30	7	17	7	5.3	
East Gulf States.							76.6	+ 4.0										72	2.64	— 1.4								4.7	
Atlanta	1,174	190	216	28.82	30.04	+ .05	74.0	+ 5.2	92	4	84	50	28	64	26	62	56	62	2.35	— 0.8	9	7,461	s.	38	nw.	1	13	13	5	4.6	
Macon	370	93	99	29.65	30.04	+ .05	75.8	.....	93	3	86	55	29	65	29	....	....	....	1.97	.....	11	4,014	s.	34	nw.	1	13	9	9	4.5	
Pensacola	56	78	96	29.96	30.02	+ .03	77.2	+ 3.7	93	21	83	65	29	71	23	....	....	....	1.75	— 1.6	11	6,996	se.	34	e.	21	15	12	4	3.8	
Mobile	57	88	96	29.95	30.01	+ .02	77.0	+ 3.4	95	21	84	60	29	70	25	70	67	77	3.00	— 1.3	8	5,369	s.	26	w.	26	16	9	6	3.8	
Montgomery	223	100	112	29.78	30.00	+ .01	77.0	+ 4.2	95	21	87	57	29	67	26	67	62	67	5.62	+ 1.6	9	4,185	se.	34	sw.	13	16	9	6	4.6	
Meridian	375	84	93	29.62	30.00	+ .02	75.0	+ 4.6	93	21	86	52	29	64	34	....	....	....	2.55	— 2.2	9	3,539	sw.	24	sw.	31	10	13	8	5.1	
Vicksburg	247	62	74	29.71	29.97	.00	76.0	+ 3.4	93	21	86	55	29	66	27	68	64	75	3.18	— 1.8	6	4,635	se.	34	w.	19	6	18	7	5.5	
New Orleans	51	88	121	29.94	29.98	+ .01	78.5	+ 3.9	94	26	86	66	8	70	23	71	68	77	1.56	— 3.3	9	5,933	se.	33	ne.	16	5	19	7	5.7	
Port Eads		27					78.5	+ 3.9	89	26	85	67	1	72	15	....	....	....	1.09	— 2.2	3	.....	se.	....	....	....	6	18	7	....	
West Gulf States.							76.0	+ 3.4										77	3.01	— 1.4								5.3	
Shreveport	249	77	84	29.69	29.95	.00	75.8	+ 2.7	93	25	85	56	29	67	27	69	67	81	3.10	— 1.1	12	5,375	se.	30	se.	18	9	13	9	5.2	
Fort Smith	457	79	94	29.45	29.92	— .01	73.7	+ 5.5	93	25	83	53	8	64	32	66	62	71	2.26	— 2.5	10	6,170	e.	50	sw.	18	5	23	3	4.9	
Little Rock	357	93	100	29.59	29.96	+ .01	74.6	+ 5.3	94	25	83	55	29	66	26	66	62	70	4.76	— 1.0	9	5,161	s.	29	sw.	18	6	17	8	5.5	
Corpus Christi	20	48	53	29.87	29.89	— .01	78.0	+ 2.6	87	19	82	63	5	74	14	73	72	84	3.05	— 0.2	5	10,968	se.	39	se.	18	9	16	6	5.1	
Fort Worth	670	106	114	29.20	29.90	— .01	74.9	.....	93	26	84	55	9	66	31	....	....	....	4.31	.....	10	8,712	se.	38	sw.	1	10	16	5	4.4	
Galveston	54	106	112	29.86	29.92	— .02	77.2	+ 1.4	85	27	80	66	5	74	10	73	71	83	2.72	— 1.1	7	9,376	se.	36	se.	18	10	14	7	5.2	
Palestine	510	73	79	29.40	29.93	.00	75.0	+ 3.7	90	31	83	56	9	66	28	69	67	81	2.02	— 3.8	8	6,408	s.	48	sw.	18	5	19	7	5.6	
San Antonio	701	80	91	29.15	29.87	— .03	77.7	+ 2.8	95	19	87	58	18	69	31	69	66	71	3.14	— 0.1	7	6,724	se.	65	w.	18	5	14	12	6.1	
Taylor	583	55	63	29.28	29.89	— .02	77.4	.....	95	26	86	60	9	68	26	....	....	....	2.23	.....	7	8,730	se.	37	se.	18	10	14	7	5.1	
Ohio Val. and Tenn.							69.1	+ 3.9										68	3.44	— 0.3								4.8	
Chattanooga	762	106	112	29.25	30.05	+ .06	72.8	+ 5.1	92	20	83	49	28	62	32	65	61	71	2.19	— 1.7	11	4,707	sw.	28	sw.	12	11	14	6	5.0	
Knoxville	1,094	10	88	29.00	30.03	+ .04	71.2	+ 5.0	91	20	83	45	29	60	35	62	57	68	2.09	— 1.8	11	4,815	sw.	45	nw.	20	15	12	4	4.2	
Memphis	397	140	154	29.58	30.00	+ .04	74.8	+ 4.6	93	21	83	53	28	66	24	68	63	73	4.49	0.0	8	6,818	s.	34	w.	26	9	16	6	5.2	
Nashville	546	122	131	29.46	30.04	+ .06	72.4	+ 4.1	92	12	82	47	28	63	31	64	60	68	4.36	+ 0.8	9	4,841	s.	30	ne.	20	16	9	6	4.3	
Lexington	989	75	102	28.99	30.06	+ .07	68.2	+ 4.6	89	20	78	40	28	58	34	....	....	....	2.43	— 1.1	12	7,434	sw.	40	n.	20	18	13	9	3.1	
Louisville	525	114	136	29.46	30.04	+ .06	70.6	+ 4.5	91	13	81	44	28	60	32	62	58	68	6.41	+ 2.7	12	6,152	sw.	36	ne.	20	13	7	11	4.8	
Evansville	431	72	82	29.54	30.00	+ .03	71.4	.....	92	20	81	45	28	62	30	....	....	....	1.36	.....	9	5,584	s.	36	sw.	23	14	10	7	4.2	
Indianapolis	822	154	164	29.14	30.03	+ .06	66.0	+ 2.8	89	22	76	41	27	56	34	58	52	65	3.66	— 0.5	12	7,398	s.	49	s.	6	4	24	3	5.5	
Cincinnati	628	152	157	29.36	30.04	+ .05	67.6	+ 2.9	89	6	78	41	10	57	36	59	54	65	5.54	+ 2.1	8	5,519	sw.	45	n.	20	9	17	5	5.0	
Columbus	824	87	100	29.16	30.02	+ .04	65.0	+ 3.0	92	22	77	37	10	54	39	56	50	65	0.95	— 3.3	8	6,034	sw.	30	w.	26	8	13	10	5.7	
Pittsburg	842	116	123	29.13	30.03	+ .04	64.5	+ 2.3	91	19	75	37	10	54	31	55	49	62	2.30	— 1.0	10	3,815	ne.	23	nw.	25	9	17	5	4.9	
Parkersburg	638	77	84	29.38	30.06	+ .07	67.0	+ 4.0	91	22	78	38	10	56	36	59	55	71	3.42	0.0	6	3,736	nw.	30	n.	22	14	11	6	4.7	
Elkins	1,940	41	50	28.01	30.03	+ .03	61.6	.....	86	6	75	29	10	48	44	56	52	74	4.08	.....	14	3,252	w.	40	w.	2	3	23	5	5.6	T.
Lower Lake Region.							56.6	— 0.2										70	3.21	— 0.2								4.9	
Buffalo	767	178	206	29.19	30.02	+ .05	54.8	+ 0.8	83	31	62	33	10	47	29	49	43	68	1.85	— 1.6	14	9,533	sw.	50	sw.	8	5	14	12	6.3	
Oswego	335	76	91	29.63	30.00	+ .03	51.8	— 2.2	88	22	61	27	10	43	36	47	42	72	3.02	+ 0.2	15	7,086	w.	30	w.	9	8	10	13	6.1	
Rochester	523	81	90	29.45	30.02	+ .05	55.2	— 1.1	88	22	64	29	10	46	34	50	44	69	1.67	— 1.7	11	6,773	w.	36	nw.	22	11	16	4	4.7	T.
Erie	713	92	102	29.25	30.02	+ .04	55.8	— 0.9	87	22	64	35	11	48	38	52	49	80	3.32	— 0.5	14	7,292	w.	36	w.	22	14	12	5	4.4	
Cleveland	762	190	201	29.21	30.03	+ .05	57.6	— 0.1	88	22	66	32	10	49	33	52	46	67	3.60	0.0	13	10,218	n.	58	w.	4	11	12	8	4.7	
Sandusky	629	62	70	29.38	30.06	+ .08	59.2	+ 0.7	90	22	68	37	10	51	37	....	....	....	4.01	+ 0.5	13	6,737	e.	41	w.	2	15	8	8	4.1	
Toledo	628	123	127	29.35	30.03	+ .06	59.8	+ 0.4	90	19	70	36	10	50	34	53	48	68	4.72	+ 1.4	13	7,803	ne.	42	w.	22	18	9	4	3.9	
Detroit	739	153	193	29.24	30.03	+ .06	58.4	+ 0.9	87	19	68	34	10	49	36	52	46	68	3.52	0.0	14	8,206	ne.	36	w.	8	12	13	6	4.8	0.5
Upper Lake Region.							53.0	+ 1.6										73	3.77	+ 0.5								5.9	
Alpena	609	63	80	29.37	30.04	+ .07	50.0	+ 1.0	81	22	58	27	11	42	40	45	40	71	2.98	— 0.5	14	7,683	se.	39	w.	8	8	10	13	6.2	
Escanaba	612	43	57	29.35	30.02	+ .05	50.4	+ 1.1	77	29	59	30	1	42	37	46	42	75	3.08	— 0.3	12	6,176	s.	39	nw.	8	7	11	13	6.3	T.
Grand Haven	632	54	92	29.33	30.01	+ .05	56.2	+ 1.8	84	19	65	31	10	47	31	51	47	74	4.58	+ 1.2	10	8,639	e.	36	sw.	8	12	13	6	4.7	4.0
Houghton	668	66	74	29.29	30.02	+ .05	50.8	.....	87	21	60	26	9	41	37	....	....	....	2.92	.....	12	6,017	e.	37	nw.	8	8	12	11	5.6	T.
Marquette	734	79	116	29.22	30.04	+ .07	50.0	+ 1.0	90	22	58	27	9	42	33	44	39	71	2.14	— 0.8	10	6,793	nw.	44	nw.	8	2	16	13	6.8	T.
Port Huron	638	70	120	29.36	30.05	+ .08	54.9	+ 1.7	85	22	65	33	1	45	37	50	45	72	4.53	+ 1.2	12	8,289	ne.	41	w.	8	7	15	9	5.5	
Sault Ste. Marie	614	40	61	29.34	30.00	+ .05	49.8	+ 2.0	79	23	59	30	11	40	31	44	39	71	2.60	+ 0.4	12	6,696	nw.	49	nw.	8	11	14	6	4.9	0.2
Chicago	823	241	274	29.13	30.02	+ .06	59.0	+ 2.9	86	18	67	36	9	51	31	53	49	74	5.08	+ 1.4	11	12,356	ne.	54	ne.	25	10	19	2	4.4	T.
Milwaukee	681	124	142	29.28	30.02	+ .06	55.6	+ 2.7	83	2	65	33	10	46	36	50	45	73	4.60	+ 1.0	14	7,927	ne.	38	w.	23	6	10	15	6.7	2.0
Green Bay	617	49	57	29.34	30.00	+ .05	56.4	+ 2.5	86	19	66	31	10	46	37	50	45	71	4.20	+ 0.8	17	7,796	se.	43	w.	24	3	14	14	6.9	1.5
Duluth	702	95	116	29.23	30.01	+ .05	47.6	— 0.4	83	29	55	27	9	40	40	43	38	76	3.89	+ 0.2	17	7,661	ne.	39	s.	19	4	12	15	6.9	5.5
North Dakota.							56.9	+ 3.4										74	3.78	+ 1.4								5.0	
Moorhead	935	54	60	28.92	29.93	— .01	57.2	+ 4.0	86	18	67	31	9	47	35	52	48	76	5.56	+ 3.1	16	8,241	se.	52	se.	1	14	5	12	5.6	0.6
Bismarck	1,674	16	29	28.14	29.90	— .02	57.4	+ 3.2	86	30	69	34	9	46	38	51	47	72	3.90	+ 0.5	13	8,007	se.	50	se.	19	16	3	12	5.0	
Williston	1,875	15	31	27.88	29.84	— .09	56.1	+ 2.9	87	28	68	33	3	44	40	50	46	74	2.69	+ 0.6	13	7,713	s.	36	se.	19	16	12	3	4.5	

TABLE I.—*Climatological data for Weather Bureau Stations, May, 1902*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.									Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
Upper Miss. Valley.							**65.8**	+ 4.4										**72**	**4.53**	**+ 0.3**									**5.5**	
Minneapolis	.....	99	208	.....	.....	.....	60.2	+ 3.4	86	20	69	34	9	51	30	.....	.....	.....	4.33	+ 0.6	15	9,749	se.	50	se.	1	3	10	18	.....	
St. Paul	837	114	124	29.05	29.94	.00	60.0	+ 2.5	85	18	68	35	9	52	29	53	49	70	3.92	+ 0.5	14	6,411	se.	33	se.	20	6	15	10	6.0	
La Crosse	714	71	87	29.22	29.99	+ .05	62.0	+ 2.6	88	20	71	33	10	53	30	.....	.....	.....	8.25	+ 5.0	19	6,043	s.	36	w.	24	8	12	11	5.6	0.3
Davenport	606	71	79	29.32	29.95	.00	65.0	+ 4.3	90	20	74	40	10	56	41	58	54	69	4.57	+ 0.2	12	6,512	e.	26	w.	6	14	6	11	5.2	
Des Moines	861	84	88	29.05	29.97	+ .04	64.7	+ 4.3	88	12	74	44	11	55	33	58	54	72	4.69	0.0	14	7,379	se.	38	w.	21	6	16	9	6.2	
Dubuque	698	100	117	29.23	29.97	+ .02	63.4	+ 3.5	88	20	73	36	10	54	35	56	51	67	8.67	+ 4.7	17	5,822	se.	28	sw.	22	7	14	10	6.0	
Keokuk	614	63	78	29.29	29.94	.00	67.7	+ 5.1	92	20	77	45	11	58	37	61	57	73	3.63	− 0.4	12	5,841	se.	32	w.	23	12	11	8	4.6	
Cairo	356	87	93	29.62	29.99	+ .03	73.0	+ 5.9	92	21	82	50	28	64	28	67	64	75	2.13	− 1.7	7	6,436	s.	34	n.	24	7	21	3	4.9	
Springfield, Ill	644	82	93	29.30	29.98	+ .03	67.9	+ 5.5	91	20	78	44	10	58	39	62	58	74	1.80	− 3.2	14	7,198	sw.	31	s.	24	9	8	14	5.8	
Hannibal	534	75	110	29.40	29.96	+ .02	68.2	+ 5.1	91	20	78	46	28	59	38	.....	.....	.....	4.83	− 0.5	12	7,094	sw.	43	sw.	23	7	14	10	5.6	
St. Louis	567	111	210	29.37	29.97	+ .02	71.8	+ 6.0	93	20	81	52	27	63	31	65	62	77	3.04	− 1.5	11	7,027	s.	52	sw.	4	10	13	8	5.2	
Missouri Valley.							**68.4**	+ 5.3										**69**	**2.89**	**− 1.1**									**5.3**	
Columbia	784	11	84	29.12	29.94	.00	68.8	+ 4.3	92	20	79	46	28	58	32	.....	.....	.....	4.33	− 0.7	11	5,773	s.	32	sw.	22	6	14	11	5.9	
Kansas City	963	78	95	28.93	29.95	+ .03	69.4	+ 5.2	90	20	78	48	7	60	27	62	58	71	5.77	+ 1.1	15	6,630	s.	36	s.	23	7	14	10	6.0	
Springfield, Mo	1,324	98	104	28.57	29.96	+ .03	69.6	+ 6.4	88	20	78	47	7	61	23	63	59	73	4.26	− 1.7	12	7,534	s.	41	sw.	18	15	11	5	4.1	
Topeka	.....	81	89	.....	.....	.....	68.8	+ 5.4	89	12	79	43	7	59	30	.....	.....	.....	4.43	− 0.6	14	7,614	s.	44	sw.	22	5	20	6	5.8	
Lincoln	1,189	75	84	28.62	29.86	− .05	65.3	+ 4.2	92	12	75	42	11	55	40	58	53	69	3.65	− 0.7	15	8,885	se.	40	se.	19	13	10	8	5.0	
Omaha	1,105	115	121	28.74	29.90	− .02	66.0	+ 4.3	92	12	75	43	11	57	30	58	53	68	2.88	− 1.5	13	6,880	se.	39	sw.	21	7	12	12	5.8	
Valentine	2,598	39	40	27.15	29.83	− .07	60.8	+ 5.0	87	30	74	39	10	48	39	53	47	65	2.17	− 0.6	11	8,259	s.	46	w.	1	17	10	4	3.9	
Sioux City	1,135	96	164	28.71	29.91	− .01	64.0	+ 5.6	87	20	75	38	27	53	39	.....	.....	.....	1.27	− 2.4	13	11,192	se.	50	s.	20	7	14	10	5.8	
Pierre	1,572	43	50	28.20	29.84	− .07	63.4	+ 7.8	89	11	75	39	9	52	43	54	46	59	0.81	− 1.5	8	6,945	e.	43	sw.	1	12	6	13	5.4	
Huron	1,306	56	67	28.51	29.90	− .02	60.2	+ 5.1	86	17	73	38	27	48	39	55	51	76	2.24	− 0.8	13	10,134	se.	51	se.	1	9	18	4	4.3	4.7
Yankton	1,233	42	49	28.57	29.88	− .04	63.4	+ 4.9	88	2	75	37	27	52	42	.....	.....	.....	1.74	− 2.6	13	7,294	se.	40	n.	2	10	14	7	5.2	
Northern Slope.							**56.6**	+ 3.1										**65**	**3.70**	**+ 1.4**									**5.2**	
Havre	2,505	46	53	27.19	29.80	− .10	56.2	+ 2.9	88	28	68	29	5	45	39	49	44	69	4.77	+ 3.2	17	7,925	sw.	36	n.	17	13	12	6	5.0	
Miles City	2,371	42	50	27.32	29.79	− .12	60.0	+ 3.6	90	29	72	34	3	48	38	54	51	74	2.86	+ 0.6	8	5,928	w.	34	w.	19	12	13	6	4.5	
Helena	4,110	88	94	25.67	29.83	− .10	52.7	+ 0.9	84	28	62	30	5	43	33	44	37	60	3.61	+ 2.0	16	5,821	sw.	38	sw.	27	7	9	15	6.2	T.
Kalispell	2,965	45	51	26.80	29.83	− .05	51.6	.....	83	13	62	31	5	41	40	44	38	69	4.50	.....	17	4,421	se.	27	n.	20	10	10	11	5.4	0.6
Rapid City	3,234	46	50	26.49	29.82	− .08	57.9	+ 5.0	83	17	69	33	6	47	38	51	44	64	2.97	− 0.6	12	5,999	se.	36	sw.	21	16	9	6	4.5	
Cheyenne	6,088	56	64	23.94	29.82	− .03	52.8	+ 2.2	82	30	65	28	6	40	39	43	35	59	2.51	+ 0.3	15	7,500	nw.	46	w.	1	7	12	12	6.3	T.
Lander	5,372	26	36	24.54	29.82	− .06	53.8	+ 2.8	83	30	68	23	3	39	42	43	33	53	1.23	− 1.0	5	3,823	sw.	42	sw.	14	8	19	4	4.8	2.0
North Platte	2,821	43	52	26.98	29.86	− .02	62.8	+ 4.6	88	2	73	38	6	52	40	55	50	69	7.98	+ 5.3	9	7,450	se.	40	se.	1	9	15	7	5.3	
Middle Slope.							**66.1**	+ 4.1										**68**	**6.42**	**+ 2.8**									**5.4**	
Denver	5,291	79	151	24.64	29.82	− .02	59.9	+ 3.5	87	31	73	35	20	46	37	48	40	59	1.98	− 0.8	10	5,928	sw.	68	nw.	1	11	13	7	4.9	
Pueblo	4,685	80	86	25.18	29.79	− .04	62.3	+ 3.6	88	31	77	36	21	48	44	48	35	48	2.57	− 0.7	6	5,870	se.	41	sw.	19	13	12	6	4.8	
Concordia	1,398	42	47	28.42	29.87	− .04	67.8	+ 5.7	94	12	77	44	11	58	42	60	55	71	8.31	+ 4.3	13	6,216	s.	32	s.	18	5	15	11	6.6	
Dodge	2,509	44	52	27.28	29.84	− .03	67.4	+ 4.5	95	2	78	45	6	56	37	59	54	70	3.35	+ 0.2	14	10,030	se.	53	se.	17	13	10	8	4.8	
Wichita	1,358	78	85	28.49	29.90	.00	69.2	+ 5.0	89	12	78	45	7	60	32	62	59	77	10.33	+ 6.1	19	6,399	s.	42	s.	1	9	9	13	5.9	
Oklahoma	1,214	54	62	28.62	29.87	− .02	70.2	+ 2.4	88	26	78	51	7	62	26	64	62	80	11.99	+ 6.5	14	8,057	s.	38	ne.	21	8	16	7	5.4	
Southern Slope.							**70.2**	+ 2.0										**65**	**7.91**	**+ 4.6**									**4.6**	
Abilene	1,738	45	54	28.06	29.83	− .04	74.1	+ 1.9	91	26	84	52	7	64	31	65	60	67	6.68	+ 2.1	11	7,892	se.	48	ne.	15	11	8	12	5.5	
Amarillo	3,676	54	61	26.12	29.77	− .07	66.2	+ 2.0	90	16	78	46	7	54	36	56	50	63	9.14	+ 6.0	10	11,641	s.	56	sw.	21	16	10	5	3.8	
Southern Plateau.							**65.4**	− 1.1										**31**	**0.60**	**0.0**									**2.6**	
El Paso	3,762	10	110	26.05	29.71	− .07	73.8	+ 1.5	100	25	88	47	20	59	45	51	27	24	T.	− 0.5	0	9,084	w.	50	sw.	18	15	12	4	3.1	
Santa Fe	7,013	47	50	23.21	29.78	− .03	57.0	+ 1.3	78	25	69	29	20	45	29	44	31	44	2.84	+ 1.8	11	5,128	sw.	36	s.	11	17	11	3	3.3	T.
Flagstaff	6,907	12	25	23.28	29.77	− .01	49.7	− 4.6	77	28	66	25	20	33	46	37	.....	.....	0.69	− 1.1	2	.....	sw.	48	sw.	17	17	10	4	3.2	
Phoenix	1,108	50	56	28.63	29.76	− .02	75.2	+ 0.9	102	28	90	48	21	60	40	52	30	23	T.	− 0.1	0	3,691	e.	24	sw.	18	19	10	2	2.7	
Yuma	141	16	50	29.60	29.75	− .04	75.2	− 1.9	102	28	91	51	20	60	38	57	40	36	0.00	0.0	0	5,216	w.	40	w.	18	28	3	0	0.7	
Independence	3,910	51	58	25.84	29.78	− .06	61.6	− 3.8	88	27	75	35	19	48	33	45	24	26	0.04	− 0.2	1	7,445	nw.	40	nw.	31	20	11	0	2.5	
Middle Plateau.							**56.3**	− 0.8										**42**	**0.28**	**− 0.7**									**4.2**	
Carson City	4,720	82	92	25.20	29.88	− .03	51.0	− 3.2	81	26	64	24	2	38	37	41	32	54	0.20	− 0.4	4	6,277	sw.	36	sw.	31	16	10	5	3.5	
Winnemucca	4,344	59	70	25.51	29.87	− .04	52.6	− 1.8	84	26	66	18	3	39	44	41	30	49	0.21	− 0.8	5	7,340	sw.	42	s.	31	13	6	12	5.5	T.
Modena	5,479	10	38	24.50	29.78	− .04	53.9	.....	85	28	70	26	18	37	47	38	18	30	0.19	.....	3	8,567	w.	56	s.	31	15	12	4	3.7	0.1
Salt Lake City	4,366	105	110	25.49	29.81	− .05	59.2	+ 1.4	88	26	70	35	5	49	32	46	34	43	0.33	− 1.4	8	5,262	se.	36	s.	31	15	10	6	3.9	0.1
Grand Junction	4,608	43	51	25.25	29.80	− .03	62.5	+ 0.4	89	26	78	37	19	48	40	46	29	35	0.37	− 0.3	5	4,927	se.	27	w.	17	14	11	6	4.3	T.
Northern Plateau.							**56.4**	− 0.9										**61**	**1.96**	**+ 0.3**									**6.3**	
Baker City	3,471	53	58	26.35	29.92	− .04	52.1	− 0.6	86	26	62	32	4	42	37	44	36	63	1.74	− 0.2	13	3,962	nw.	26	nw.	17	3	7	21	7.4	
Boise	2,739	61	68	27.06	29.89	− .05	57.6	− 0.5	90	27	70	33	2	45	38	46	37	56	1.12	− 0.5	9	3,335	nw.	22	sw.	16	9	11	11	5.6	0.6
Lewiston	757	52	61	29.08	29.88	− .08	59.8	− 0.5	90	26	70	41	1	49	38	.....	.....	.....	2.72	+ 0.6	16	2,823	e.	27	w.	17	6	10	15	6.2	
Pocatello	4,482	46	54	25.36	29.84	− .05	55.2	+ 0.9	85	26	67	29	4	43	40	44	34	52	1.67	+ 0.5	12	6,288	se.	41	sw.	31	11	15	5	4.6	5.8
Spokane	1,943	99	107	27.87	29.91	− .05	55.4	− 1.6	85	27	65	38	18	46	34	47	41	64	1.83	+ 0.4	15	4,540	sw.	24	sw.	14	4	4	23	8.1	
Walla Walla	1,000	65	73	28.85	29.92	− .04	58.0	− 2.9	87	26	68	39	4	48	35	52	47	71	2.68	+ 1.0	12	4,522	s.	25	w.	17	5	19	7	5.7	
N. Pac. Coast Reg.							**54.1**	− 0.3										**76**	**2.72**	**− 0.2**									**7.2**	
Neah Bay	50	7	50	29.91	29.95	− .06	50.6	− 1.9	63	25	55	41	3	46	19	49	47	86	4.46	− 0.8	16	6,244	sw.	36	w.	17	5	6	20	7.8	
Port Crescent	259	13	20	29.71	29.94	− .08	50.6	+ 0.2	76	26	58	35	19	44	31	.....	.....	.....	2.19	− 0.3	15	3,604	w.	20	w.	27	2	16	13	6.9	
Seattle	123	114	151	29.86	29.99	− .02	56.5	+ 1.2	83	26	64	42	18	49	31	50	45	72	1.86	− 0.5	17	4,976	s.	37	sw.	10	2	20	9	6.5	
Tacoma	213	113	120	29.76	29.98	− .04	55.5	+ 1.4	82	26	63	41	18	48	31	.....	.....	.....	1.83	− 0.7	14	4,631	sw.	27	sw.	17	2	14	15	7.3	
Astoria	20	57	64	.....	.....	.....	53.2	− 1.2	71	26	60	39	1	47	24	.....	.....	.....	4.09	+ 0.3	20	.....	sw.	.....	.....	.....	4	8	19	7.2	
Portland, Oreg	154	203	213	29.83	29.98	− .05	56.2	− 1.1	90	26	64	41	1	49	31	50	46	73	2.19	− 0.2	19	5,946	nw.	32	w.	17	4	7	20	7.5	
Roseburg	518	56	67	29.44	30.00	− .03	56.1	− 0.8	88	26	65	37	4	47	37	50	45	72	2.43	+ 0.5	16	2,964	nw.	24	sw.	16	4	10	17	7.1	
Mid. Pac. Coast Reg.							**56.9**	− 1.5										**71**	**1.32**	**− 0.2**									**4.3**	
Eureka	62	62	80	29.98	30.06	+ .01	54.2	+ 1.5	72	6	59	42	3	50	18	50	46	78	2.70	− 0.1	14	6,828	n.	45	n.	18	5	19	7	5.3	
Mount Tamalpais	2,375	11	18	27.51	29.99	− .01	50.3	.....	78	25	57	36	19	44	29	44	39	70	1.30	.....	6	16,119	nw.	86	nw.	16	16	12	3	3.8	
Red Bluff	332	50	56	29.60	29.96	+ .01	62.5	− 4.5	95	25	74	41	2	51	36	52	42	56	1.12	− 0.2	6	4,542	se.	38	nw.	17	14	10	7	4.1	
Sacramento	69	106	117	29.87	29.94	.00	60.0	− 3.5	89	25	71	42	2	50	33	52	46	66	0.45	− 0.5	4	7,353	s.	45	nw.	18	17	6	8	3.7	
San Francisco	155	161	167	29.86	30.03	+ .04	55.5	− 1.1	70	5	60	47	2	50	19	52	49	85	1.05	+ 0.3	6	9,569	w.	36	w.	24	14	9	8	4.1	
Point Reyes Light	490	7	30	29.45	29.97	.....	52.3	+ 0.1	62	13	57	41	19	48	13	.....	.....	.....	1.28	− 0.7	7	21,047	nw.	110	nw.	18	14	4	13	5.0	
S. Pac. Coast Reg.							**60.8**	− 1.5										**66**	**0.03**	**− 0.4**									**3.6**	
Fresno	330	67	70	29.56	29.91	− .01	64.4	− 3.6	90	26	78	44	3	50	38	52	40	49	0.01	− 0.4	1	6,726	nw.	36	w.	18	19	6	6	3.2	
Los Angeles	338	74	82	29.57	29.93	− .02	60.7	− 1.4	80	6	71	43	21	50	27	54	49	74	0.03	− 0.4	1	3,998	w.	24	nw.	18	8	22	1	4.4	
San Diego	87	94	102	29.85	29.94	− .01	60.2	− 0.2	78	6	64	50	20	56	22	55	51	75	0.06	− 0.3	2	4,861	sw.	27	nw.	19	22	4	5	3.5	
San Luis Obispo	201	10	46	29.80	30.02	+ .02	58.1	− 0.9	82	5	70	37	20	46	40	50	46	73	0.03	− 0.3	1	4,843	w.	28	w.	18	20	7	4	3.4	
West Indies.																														
Basseterre	29	41	54	29.89	29.92	− .08	79.0	.....	86	28	84	70	22	74	15	75	73	80	10.27	.....	20	5,312	e.	27	sw.	25	4	19	8	6.0	
Bridgetown	30	57	65	29.87	29.91	− .05	80.2	+ 1.8	88	23	85	72	4	75	14	75	73	77	3.49	+ 0.5	14	6,123	se.	25	se.	24	5	8	18	6.9	
Cienfuegos	52	62	67	29.88	29.93	− .01	79.4	.....	93	29	88	68	11	71	21	72	69	73	2.87	.....	9	5,275	ne.	20	sw.	19	9	20	2	4.4	
Grand Turk	11	6	20	29.95	29.96	− .04	80.3	.....	90	27	87	69	4	74	19	.....	.....	.....	2.17	.....	6	.....	e.	.....	.....	.....	5	16	10	5.7	
Havana	57	87	105	29.90	29.97	+ .03	77.5	− 1.3	89	19	84	67	5	71	17	73	70	79	0.85	− 3.6	2	9,398	e.	39	ne.	23	19	11	1	3.2	
Kingston	286	38	52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Port of Spain	40	65	66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Puerto Principe	352	55	62	29.60	29.96	+ .01	78.8	.....	94	18	89	64	8	68	27	72	70	80	0.94	.....	7	5,952	ne.	24	e.	17	11	17	3	4.5	
Roseau	25	37	47	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
San Juan	82	48	90	29.84	29.92	− .07	78.2	.....	89	28	84	68	16	73	17	74	73	84	13.97	+ 9.3	22	6,438	e.	27	se.	11	3	11	17	7.0	
Santiago de Cuba	82	46	52	29.83	29.91	− .02	79.0	.....	90	12	88	66	15	70	21	72	70	79	5.44	.....	18	4,570	n.	30	ne.	31	2	26	3	5.8	
Santo Domingo	57	37	44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Willemstad	75	39	46	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	

NOTE.—The data at stations having no departures are not used in computing the district averages. *More than one date.

TABLE II.—*Climatological record of voluntary and other cooperating observers, May, 1902.*

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Ashville	96	45	73.6	0.59	
Benton				6.10	
Bermuda	97	57	77.2	3.03	
Birmingham	95	49	75.9	3.29	
Bridgeport				1.61	
Burkville				3.45	
Calera				1.65	
Citronelle	93	59	76.4	3.70	
Clanton	91	55	73.7	4.89	
Cordova	98				
Daphne	94	58	76.3	5.53	
Decatur	99	50	77.0	1.28	
Demopolis				2.56	
Dothan		59		4.06	
Elba	98	54	76.7	2.08	
Eufaula *a*	95	54	77.3	2.09	
Eutaw	95	57	76.6	3.52	
Evergreen	95	58	76.5	4.75	
Flomaton	94	54	75.7	7.65	
Florence *a*				0.37	
Florence *b*	97	43	75.3	0.47	
Fort Deposit	95	57	76.9	3.62	
Gadsden	100	47	76.9	0.91	
Goodwater	94	54	75.2	2.01	
Greensboro	94	58	77.0	4.91	
Greenville				5.65	
Hamilton	94°	42°	73.8°	0.41	
Helena				3.24	
Highland Home	93	59	75.0	1.83	
Letohatchie				0.95	
Livingston *a*	93	53	74.8	2.39	
Lock No. 4	98	49	75.8	1.43	
Madison Station	94	45	74.5	0.92	
Maplegrove	98	47	74.0	0.89	
Marion	92	55	75.5	1.30	
Mount Willing	97	55	78.4	4.73	
Newbern	98	54	78.2	3.51	
Notasulga				1.81	
Oneonto	91	47	72.8	2.14	
Opelika	93	52	76.2	0.87	
Oxanna	94	49	74.4	1.21	
Ozark	97	59	76.8	5.59	
Prattville	96	51	74.8	1.80	
Pushmataha	92	51	75.2	1.91	
Riverton	93	43	73.4	1.45	
Scottsboro	92	43	73.0	2.35	
Selma	98	56	77.4	2.16	
Talladega	97	49	75.6	0.85	
Tallassee				2.12	
Thomasville	96	55	77.8	1.37	
Tuscaloosa	97	52	76.4	2.56	
Tuscumbia	93	50	75.6	1.24	
Tuskegee	97	55	78.1	2.19	
Union Springs	95	56	77.4	4.30	
Uniontown	95	52	75.6	3.65	
Valleyhead	95	47	73.7	2.37	
Verbena				4.06	
Wetumpka	98	53	78.0	1.84	
Alaska.					
Juneau	65	35	48.3	3.99	
Killisnoo	56	32	44.3	3.70	
Sitka	64	34	45.7	6.10	
Arizona.					
Allaire Ranch				0.08	
Arizona Canal Co's Dam	109	50	75.6	0.41	
Ashfork	89	17	52.8	0.00	
Aztec *1	111	63	85.4	0.00	
Benson *1	86	60	75.7	0.00	
Bisbee	88	40	66.6	0.40	
Buckeye	109	46	73.0	0.00	
Chample Camp	103	38	71.4	0.30	3.0
Cochise *1	95	40	75.3	0.20	
Congress	94	45	72.0	0.00	
Dragoon Summit *1	90	47	70.1	0.71	
Dudleyville	100	37	70.6	0.16	
Duncan	95	31	65.0	0.36	
Fort Apache	89	31	58.7	1.32	
Fort Defiance	81	24	53.4	1.50	
Fort Grant	90	40	66.5	0.30	
Fort Huachuca	91	45	71.4	0.60	
Fort Mohave	109	50	76.6	0.00	
Gilabend *1	103	59	76.4	0.00	
Globe	95	39	65.8	0.70	
Jerome	89	35	66.2	0.40	
Maricopa *1	103	58	78.3	T.	
Mesa	101	45	72.8	T.	
Mesa (near)	102	47	72.8	0.00	
Mohawk Summit *1	110	64	83.6	0.00	
Mount Huachuca	92	42	67.5	0.08	
Natural Bridge				0.76	
Nogales	93	24	64.8	T.	
Oracle	89	37	67.0	0.94	
Oro				0.47	
Parker	109	46	76.2	0.00	
Phoenix	104	44	73.8	0.05	
Pima	99	36	69.9	0.04	
Pinal Ranch				0.46	
Prescott	85	33	56.4	T.	
St. Johns	92	32	61.8	0.86	
San Carlos	100	42	70.6	0.60	
Sentinel *1	105	67	85.3	0.00	
Showlow				2.07	10.0
Signal	106	37	72.5	0.00	
Silverking				0.15	
Superstition				0.07	
Taylor	87	27	56.7	1.16	T.
Tombstone	92	39	69.5	0.06	
Tonto	96	41	68.7	1.06	
Tuba	91°	38°	63.9°	0.15	
Tucson	98	39	71.5	T.	
Vail *5	95	58	77.6	T.	
Walnut Grove				0.00	
Willcox *1	92	50	73.2	0.40	
Yarnell				T.	
Arkansas.					
Alco	90	46	71.9	2.93	
Amity	91	48	72.9	3.99	
Arkansas City				2.50	
Batesville	97	50	74.0	1.73	
Beebranch	95[4]	48[4]	72.6[4]	3.90	
Blanchard Springs	93	51	74.1	6.59	
Brinkley	96	51	74.2	3.22	
Camden *a*				7.38	
Camden *b*	94	52	75.5	6.84	
Conway	98	50	74.8	3.21	
Corning	93	48	72.8	3.40	
Dallas	92	51	73.2	5.43	
Dardanelle				4.01	
Dutton	87	46	68.0	5.19	
Elon	94°	48°	73.7°	6.03	
Eureka Springs	89	45	70.7	5.88	
Fayetteville	92	43	71.6	4.33	
Forrest City	98	50	76.0	4.20	
Fulton				5.15	
Helena *a*				4.15	
Helena *b*	95	52	74.8	5.59	
Jonesboro	97	49	75.2	3.04	
Keesees Ferry	90	45	71.2	7.28	
Lacrosse	93	51	72.6	3.72	
Lonoke	96	48	73.2	4.89	
Lutherville	99	44	72.2	3.32	
Malvern	96	49	74.1	7.05	
Marianna	97	49	75.2	4.47	
Marvell	98	49	75.1	5.26	
Mossville	87	47	69.0	7.62	
Mountain Home	93	45	72.2	3.77	
Mount Nebo	90	50	71.6	3.15	
Newport *a*				2.18	
Newport *b*	98	51	74.8	2.65	
Newport *c*	98	49	74.6	2.06	
Oregon	91	44	70.3	4.76	
Osceola	95	49	75.1	3.92	
Ozark	96	51	75.2	3.80	
Pinebluff	99	52	75.3	2.70	
Pocahontas	97	47	73.2	4.84	
Pond	90	43	70.6	4.31	
Prescott	91	46	73.8	5.57	
Princeton	94	47	73.7	4.85	
Rison	99	46	75.2	3.39	
Rosadale	96	44	74.9	8.44	
Russellville	97	50	73.2	3.67	
Silversprings	92	45	70.4	2.77	
Spielerville	96	49	73.6	3.77	
Stuttgart	94	50	73.8	3.29	
Texarkana	98	50	76.1	3.15	
Warren	94	50	73.6	4.18	
Washington	90	53	73.3	6.06	
Wiggs	92	42	72.7	5.22	
Winchester	96	50	74.4	3.53	
Winslow	85	59	68.4	6.97	
Witts Springs	84	42	65.9	3.56	
California.					
Angiola	92	38	63.4	0.17	
Bakersfield	89	41	64.3	0.17	
Ballast Point L. H	91	41	64.8	0.91	
Bear Valley				0.00	
Berkeley	72	42	57.0	2.80	3.0
Bishop	92	30	59.6	1.69	
Boca *1	62	15	42.0	0.06	
Bodie	72	10	39.8	T.	T.
Bowman	76	27	48.4	0.50	4.5
Branscomb				2.76	
Caliente *1	89	42	57.8	3.27	
Campbell	82	34	56.2	0.11	
Campo				0.58	
Cape Mendocino L. H				0.06	
Cedarville	84	25	50.4	3.05	
Chico *1	93	52	66.0	0.95	3.0
Cisco *1	65	25	38.2	0.76	
Claremont	81	37	57.8	0.90	9.0
Cloverdale	83	37	59.2	0.10	
Corning *1	95	48	63.3	3.09	
Coronado	88	62	72.0	1.80	
Crescent City	68	36	53.4	0.06	
Crescent City L. H				6.29	
Cuyamaca *5	70	27	48.4	6.46	
Delano *1	92	40	67.7	0.14	
Delta *1	87	46	60.1	0.20	
Drytown	91	35	61.0	4.02	
Dunnigan *1	96	52	65.4		
Durham *5	94	40	61.9	0.92	
East Brother L. H				1.78	
Edmanton *1	84	29	47.5	0.50	
Elcajon	90	41	61.5	2.49	5.0
Elmdale	93	34	61.0	0.04	
Elsinore	90	38	62.2	0.56	
Escondido	86	38	62.8	T.	
Fallbrook	88	40	62.8		
Folsom City *1	96	50	65.0	0.11	
Fordyce Dam				1.49	
Fort Bragg				2.93	10.0
Fort Ross	68	42	54.8	1.97	
Foster				2.38	
Georgetown	87	32	55.3	0.19	
Geyserville	70	44	61.0	1.44	
Gilroy (near)	84	35	57.6	2.59	
Grass Valley				0.15	
Greenville	88	25	50.4	1.84	
Hanford	96	33	64.4	1.03	T.
Healdsburg	78	37	58.0	0.09	
Hollister	82	33	57.0	2.21	
Humboldt L. H				0.06	
Imperial	113	51	82.0	3.11	
Indio *1	104	62	79.0	0.00	
Iowa Hill *1	84	40	56.4	0.00	
Jackson	84	39	56.8	1.04	
Jolon				1.99	
Keene *6	82	40	55.7	0.08	
Kennedy Gold Mine	83	31	54.8	0.45	
Kent				3.40	
Kernville				2.06	
Kingsburg *6	90	55	72.3	0.10	
Kono Tayee	84	38	57.6		
Laguna Valley				1.59	
Laporte *1	78	30	45.6	0.11	
Las Fuentes Ranch				2.28	4.5
Legrande				T.	
Lemoncove	93	36	64.8	0.30	
Lick Observatory	71	29	46.3	0.20	
Lime Point L. H				1.14	
Lodi	90	36	60.8	1.01	
Los Gatos	82	38	57.4	0.60	
Mammoth *1	104	60	81.7	1.17	
Mare Island L. H				0.00	
Merced	90	40	63.8	0.95	
Mercury	84	40	63.4	0.50	
Mills College				2.30	
Milo				1.15	
Milton (near)	88	42	60.8	0.54	
Modesto *1	93	50	65.5	0.97	
Mohave *1	90	40	60.0	0.39	
Mokelumne Hill *2		40	53.0	0.00	
Monterio	80	34	55.2	1.38	
Monterey *1	68	47	57.3	0.42	
Mount St. Helena				0.03	
Mutah				3.39	
Napa	75	36	57.8	1.41	
Needles	105	57	80.7	1.23	
Nevada City	86	29	52.2	0.00	
Newcastle	96	45	64.2	1.47	
Niles	78	38	58.9	1.01	
North Bloomfield	89	30	54.0	1.40	
North Ontario	80	40	59.0	1.70	T.
North San Juan *1	84	37	53.1	0.13	
Oakland	75	42	59.5	2.35	
Ogilby *1	108	60	81.4	1.13	
Orland *1	102	50	65.7	0.00	
Palermo	98	35	61.8	1.97	
Paso Robles	86	32	57.2	0.89	
Peachland *5	71	43	58.8	0.00	
Piedras Blancas L. H				2.03	
Pigeon Point L. H				0.16	
Pine Crest	82	43	59.6	0.05	
Placerville	84	31	56.1	0.11	
Point Ano Nuevo L. H				1.35	
Point Arena L. H				1.12	
Point Bonita L. H				1.68	
Point Conception L. H				1.63	
Point Fermin L. H				0.07	
Point George L. H				0.00	
Point Hueneme L. H				1.23	
Point Lobos	65	45	54.4	0.02	
Point Loma L. H				0.98	
Point Montara L. H				0.00	
Point Pinos L. H				1.14	
Point Sur L. H				0.34	
Pomona (near)	90	40	64.1	0.70	
Poway	85	44	63.0	0.10	
Quincy	85	28	53.1	0.10	
Redding	93	38	61.7	1.13	T.
Redlands	91	42	64.3	2.94	
Reedley	93	50	71.5	0.08	
Represa	86	40	60.6	0.28	
Cuyamaca *5	70	27	48.4	0.14	
Delano *1	92	40	67.7	0.20	
Delta *1	87	46	60.1	4.02	
Drytown	91	35	61.0		
Dunnigan *1	96	52	65.4	0.92	
Durham *5	94	40	61.9	1.78	
East Brother L. H				0.50	
Edmanton *1	84	29	47.5	2.49	5.0
Elcajon	90	41	61.5	0.04	
Elmdale	93	34	61.0	0.56	
Elsinore	90	38	62.2	T.	
Escondido	86	38	62.8		
Fallbrook	88	40	62.8	0.11	
Folsom City *1	96	50	65.0	1.49	
Fordyce Dam				2.93	10.0
Fort Bragg				1.97	
Fort Ross	68	42	54.8	2.38	
Foster				0.19	
Georgetown	87	32	55.3	1.44	
Geyserville	70	44	61.0	2.59	
Gilroy (near)	84	35	57.6	0.15	
Grass Valley				1.84	
Greenville	88	25	50.4	1.03	T.
Hanford	96	33	64.4	0.09	
Healdsburg	78	37	58.0	2.21	
Hollister	82	33	57.0	0.06	
Humboldt L. H				3.11	
Imperial	113	51	82.0	0.00	
Indio *1	104	62	79.0	0.00	
Iowa Hill *1	84	40	56.4	1.04	
Jackson	84	39	56.8	1.99	
Jolon				0.08	
Keene *6	82	40	55.7	0.45	
Kennedy Gold Mine	83	31	54.8	3.40	
Kent				2.06	
Kernville				0.10	
Kingsburg *6	90	55	72.3		
Kono Tayee	84	38	57.6	1.59	
Laguna Valley				0.11	
Laporte *1	78	30	45.6	2.28	4.5
Las Fuentes Ranch				T.	
Legrande				0.30	
Lemoncove	93	36	64.8	0.20	
Lick Observatory	71	29	46.3	1.14	
Lime Point L. H				1.01	
Lodi	90	36	60.8	0.60	
Los Gatos	82	38	57.4	1.17	
Mammoth *1	104	60	81.7	0.00	
Mare Island L. H				0.95	
Merced	90	40	63.8	0.50	
Mercury	84	40	63.4	2.30	
Mills College				1.15	
Milo				0.54	
Milton (near)	88	42	60.8	0.97	
Modesto *1	93	50	65.5	0.39	
Mohave *1	90	40	60.0	0.00	
Mokelumne Hill *2		40	53.0	1.38	
Monterio	80	34	55.2	0.42	
Monterey *1	68	47	57.3	0.03	
Mount St. Helena				3.39	
Mutah				1.41	
Napa	75	36	57.8	1.23	
Needles	105	57	80.7	0.00	
Nevada City	86	29	52.2	1.47	
Newcastle	96	45	64.2	1.01	
Niles	78	38	58.9	1.40	
North Bloomfield	89	30	54.0	1.70	T.
North Ontario	80	40	59.0	0.13	
North San Juan *1	84	37	53.1	2.35	
Oakland	75	42	59.5	1.13	
Ogilby *1	108	60	81.4	0.00	
Orland *1	102	50	65.7	1.97	
Palermo	98	35	61.8	0.89	
Paso Robles	86	32	57.2	0.00	
Peachland *5	71	43	58.8	2.03	
Piedras Blancas L. H				0.16	
Pigeon Point L. H				0.05	
Pine Crest	82	43	59.6	0.11	
Placerville	84	31	56.1	1.35	
Point Ano Nuevo L. H				1.12	
Point Arena L. H				1.68	
Point Bonita L. H				1.63	
Point Conception L. H				0.07	
Point Fermin L. H				0.00	
Point George L. H				1.23	
Point Hueneme L. H				0.02	
Point Lobos	65	45	54.4	0.98	
Point Loma L. H				0.00	
Point Montara L. H				1.14	
Point Pinos L. H				0.34	
Point Sur L. H				0.70	
Pomona (near)	90	40	64.1	0.10	
Poway	85	44	63.0	0.10	
Quincy	85	28	53.1	1.13	T.
Redding	93	38	61.7	2.94	
Redlands	91	42	64.3	0.08	
Reedley	93	50	71.5	0.28	
Represa	86	40	60.6	1.25	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Riovista	87	43	62.3	0.53	
Riverside	88	37	62.2	0.16	
Roe Island L. H.				0.67	
Rohnerville *b	80	46	56.6	2.60	
Rosewood	96	38	61.5	1.44	
Sacramento	90	40	62.4	0.65	
Salinas	84	33	57.0	0.29	
Salton *1	108	62	83.7	0.00	
San Bernardino	89	37	62.5	0.12	
San Jacinto	91	40	63.4	0.01	
San Jose	83	35	57.6	0.88	
San Leandro	78	38	57.8	1.46	
San Luis L. H.				0.04	
San Mateo *1	76	51	60.9	1.20	
San Miguel *1	83	44	61.4	0.00	
Santa Barbara	81	45	59.0	0.07	
Santa Barbara L. H				0.03	
Santa Clara				0.59	
Santa Cruz	80	35	56.5	0.64	
Santa Cruz L. H				0.61	
Santa Maria	83	35	56.6	0.20	
Santa Monica	71	44	56.3	0.00	
Santa Rosa *1	86	35	58.3	1.79	
Shasta	100	37	65.2	3.65	
Sierra Madre	83	44	61.2	0.36	
Sonoma				1.16	
S. E. Farallone L. H				0.73	
Stockton	80	42	58.8	0.61	
Storey	92	36	62.7	0.38	
Summerdale	73	25	47.6	1.33	
Susanville	86	31	55.7	0.35	
Tehama *1	90	49	67.7	1.41	
Tejon Ranch	88	44	63.6	0.98	
Templeton *5	87	40	54.9	0.00	
Trinidad L. H				4.15	
Truckee *1	76	30	45.4	0.55	2.0
Tulare *b*				0.28	
Tulare *c*	92	40	64.9	0.14	
Ukiah	94	32	56.6	1.67	
Upperlake	92	34	56.4	1.60	
Upper Mattole *1	80	39	54.3	5.85	
Vacaville *1	92	48	61.8	1.24	
Ventura	75	43	59.0	0.07	
Visalia				0.31	
Volcano Springs *1	112	68	84.2	0.00	
Wasco	91	41	65.1	0.15	
Westpoint				1.92	
West Saticoy				0.30	
Wheatland	88	38	61.1	1.31	
Williams *1	97	50	66.7	0.84	
Willits	92	36	57.0	2.09	
Willows	96	42	61.8	1.93	
Wilmington *1	78	40	58.1	T.	
Wire Bridge *5	92	46	63.6	0.92	
Yerba Buena L. H				0.34	
Yreka	90	33	55.0	1.08	
Yuba City *5	86	49	67.7	1.57	
Zenia				2.95	
Colorado.					
Alford	79	27	52.8	1.85	
Arkins				2.78	
Ashcroft	75	14	45.9	2.56	2.8
Blaine	96	34	66.0	3.32	
Boulder	82	34	59.2	2.32	
Boxelder				4.53	
Breckenridge	70	11	41.8	1.25	T.
Buenavista				0.10	
Canyon	87	37	61.7	1.65	
Castlerock	84	30	57.6	2.70	
Cedaredge	85	39	56.8	1.30	T.
Cheyenne Wells *f*	92	35	60.6	3.14	
Clearview	70	12	46.6	1.68	T.
Collbran	87	28	57.2	1.22	
Colorado Springs	79	36	57.0	5.23	
Delta	90	29	59.6	1.29	T.
Durango	83	28	55.4	0.99	
Fort Collins	86	30	56.1	2.13	
Fort Morgan	87	33	60.2		
Fox	88	34	61.2	5.00	
Garnett	82	20	50.4	1.18	T.
Gilman				1.20	10.0
Gleneyre	80	27	56.1	2.14	
Glenwood	87			0.62	
Greeley	87	34	58.5	1.77	
Grover				2.23	
Gunnison	80	18	49.4	1.19	1.2
Hamps	80	28	56.4	4.97	
Hoehne	87	31	60.9	4.43	
Holly	95	43	66.5	2.83	
Holyoke (near)	85	33	60.4	4.93	
Husted	80	29	54.6	3.89	
Lake Moraine	66	20	42.8	3.38	6.2
Lamar	95	38	67.8	3.96	
Laporte				2.16	
Las Animas	91	35	64.7	4.73	
Lay	83	16	50.0	0.76	
Leadville (near)				0.51	1.0
Leroy	83	33	58.5	3.16	
Longs Peak	67	15	42.8	2.90	6.0
Marshall Pass				1.40	15.5
Meeker	85	23	52.6	0.65	
Mitchell				0.50	5.0
Montrose				1.27	
Moraine	71	24	47.0	1.15	
Pagoda	82	23	51.1	1.08	3.0
Parachute	90	29	59.0	0.29	
Rockyford	89	35	63.9	4.02	
Rogers Mesa	88	31	58.3	1.45	
Ruby				0.54	5.0
Russell	85	18	47.6	1.60	
Saguache	79	19	54.6	1.86	
Salida	83	26	54.1	1.60	
San Luis	78	20	50.6	1.83	
Santa Clara	81	27	53.3	3.18	
Sapinero				0.59	
Seibert				4.75	
Silt	86	29	56.8	1.15	1.5
Sugarloaf	75	25	51.2	2.69	2.0
Telluride	75	18	48.5	2.83	T.
Trinidad	85	36	60.2	3.73	
Twinlakes				1.52	T.
Vilas				3.63	
Wagon Wheel	78	11	44.0	0.93	
Wallet				4.45	
Westcliffe	78	25	50.3	1.55	0.3
Whitepine	68	19	42.4	1.49	2.0
Wray	87	36	62.2	7.00	
Yuma				3.76	
Connecticut.					
Bridgeport	88	35	58.0	1.59	
Canton	85	29	54.2	1.44	
Clinton	82	35	54.8	2.01	
Colchester	86	31	57.4	1.55	
Falls Village				2.65	
Hartford	88	33	57.8	1.80	
Hawleyville	88	29	56.6	2.36	
Lake Konomoc				1.55	
Middletown	90	32	58.0	0.80	
New London	86	39	59.0	1.76	
North Grosvenor Dale	89	31	56.7	1.45	
Norwalk	90	32	58.2	2.60	
Southington	87	32	57.0	1.65	
South Manchester				1.34	
Storrs	87	27	55.6	1.59	
Voluntown	84°	31°	55.8°	1.21	
Wallingford				1.53	
Waterbury	91	32	58.4	2.01	
West Cornwall	86	25	53.8	2.99	
West Simsbery				1.61	
Delaware.					
Milford	94	39	65.2	1.99	
Millsboro	91	37	63.5	1.60	
Newark	88	37 *f*	61.9°	1.66	
Seaford	88	40	64.6	2.29	
District of Columbia.					
Distributing Reservoir *5	87	48	67.3	4.56	
Receiving Reservoir *5	86	48	66.8	3.60	
West Washington	92	38	66.1	3.95	
Florida.					
Archer	95	60	77.7	3.51	
Avon Park	97	60	78.6	3.71	
Bartow	93	60	79.0	2.18	
Bonifay	96	57	77.0	0.22	
Brooksville	95	63	79.0	2.54	
Carrabelle	97	62	77.9	2.10	
Clermont	96	64	80.1	1.00	
De Funiak Springs	98	57	76.8	2.46	
Deland	97	62	78.6		
Eustis	95	63	79.6	3.55	
Fernandina	92	63	76.4	2.32	
Flamingo	94	65	78.9	3.05	
Fort Meade	98	59	78.4	3.70	
Fort Myers	93	62	78.4	1.23	
Fort Pierce	95	60	76.2	0.62	
Gainesville	99	63	79.2	1.14	
Holts	97°	57°	77.4°	2.15	
Huntington	98	59	77.5	0.75	
Hypoluxo	95	63	76.3	3.98	
Inverness	94	62	78.1	5.58	
Jasper	95	60	76.2	2.27	
Kissimmee	99	60	79.6	0.34	
Lake Butler	95	51	75.6	1.51	
Lake City	97	59	78.1	1.79	
Macclenny	101	56	77.8	1.50	
Malabar	95	61	77.4	2.88	
Manatee	95	60	77.6	1.06	
Marco	94	63	78.8	4.79	
Marianna	95	58	76.2	4.99	
Merritt Island	92	68	78.4	1.83	
Miami	92	67°	80.2	0.94	
Micanopy	96	59	77.7	4.25	
Molino	98	60	78.0	3.60	
New Smyrna	97	56	75.2	0.85	
Nocatee	97	59	79.2	9.57	
Ocala	96	60	78.2	2.32	
Orange City	97	56	77.2	1.15	
Orlando	93	60	78.2	1.52	
Pinemount	98	59	77.4	3.31	
Plant City	94	57	76.8	1.37	
Quincy	98	54	78.6	2.08	
Rideout	97	55	76.0	2.17	
Rockwell	99	62	79.3	4.65	
St. Andrews	97	59	76.7	7.81	
St. Augustine	91	66	77.2	0.49	
St. Leo	96	61	79.4	1.93	
Stephensville	95			2.35	
Sumner	95	54	76.1	2.63	
Switzerland	98	58	76.4	1.32	
Tallahassee	93	61	76.7	2.86	
Tarpon Springs	94	63	77.7	1.11	
Titusville	97	58	76.8	0.27	
Waukeenah	99	61	78.2	2.90	
Wausau	99	51	77.3	3.72	
Wewahitchka	99	59	77.0	4.62	
Georgia.					
Adairsville	92	49	74.2	0.40	
Albany	99	59	79.2	6.28	
Allapaha	96	58	76.9	1.36	
Allentown	97	50	77.0	4.49	
Alpharetta	92	41	72.2	1.18	
Americus	96	57	78.2	4.09	
Athens	92	52	73.8	0.86	
Bainbridge	95	57	77.4	3.18	
Blakely	93			3.70	
Bowersville	95	45	73.1	2.65	
Brent	97	49	75.9	2.43	
Butler				2.74	
Camak	95	52	76.0	1.12	
Canton				0.29	
Carlton				1.98	
Clayton	90	43	68.6	3.77	
Columbus	93	59	77.8	2.00	
Covington	98	48	75.4	2.63	
Dahlonega	89	45	70.8	1.55	
Diamond	91	45	68.8	2.30	
Douglas	100	58	78.5	3.25	
Dublin				4.33	
Eastman	99	58	78.6	2.46	
Elberton	97	54	75.4	1.87	
Experiment	93	51	75.2	0.79	
Fitzgerald	100	55	78.6	2.15	
Fleming	98	50	75.9	3.54	
Fort Gaines	98	57	79.1	3.31	
Franklin	99			1.45	
Gainesville	92	47	72.1	3.41	
Gillsville	93	44	72.8	1.90	
Greensboro	94	48	73.8	1.88	
Griffin	97	50	76.8	1.40	
Harrison	96	51	76.6	0.96	
Hawkinsville	98	51	76.7	2.04	
Hephzibah	98	55	77.6	1.76	
Jesup	95	59	76.8	1.91	
Lost Mountain	94	47	74.6	1.29	
Louisville	95 *g*		76.0 *i*	3.62	
Lumpkin	99	53	77.4	1.75	
Marshallville	96	61	78.8	1.67	
Mauzy	100	56	78.2	2.48	
Milledgeville	94	53	75.8	1.67	
Millen	102	55	78.8	1.90	
Monticello	98	49	76.2	2.84	
Morgan	95	56	75.5	1.61	
Naylor	100	58	78.2	1.90	
Newnan	94	49	75.4	1.31	
Oakdale				1.89	
Point Peter	100	44	73.8	2.80	
Poulan	96	53	75.9	1.77	
Putnam	100	54	78.0	5.01	
Quitman	98	60	77.2	2.00	
Ramsey	90	41	72.4	1.18	
Resaca				0.50	
Rome	96	46	74.7	0.63	
St. Marys	96	57	77.0	2.09	
Statesboro	98	55	77.4	2.51	
Stillmore	98	57	77.0	5.38	
Talbotton	95	51	75.5	2.90	
Tallapoosa	97	45	74.8	0.56	
Thomasville	101	62	78.4	1.20	
Toccoa	93	48	72.3	1.51	
Valona	96	57	75.8	1.10	
Vidalia	98	57	76.6	5.11	
Washington	95	54	75.1	2.87	
Waverly	99	56	76.2	3.65	
Waycross	93	61	77.2	6.65	
Waynesboro	93	56	75.4	0.90	
Westpoint	94	53	76.6	2.86	
Woodbury	96	46	74.4	3.37	
Idaho.					
Albion	86	25	51.8	2.55	
Blackfoot	91	24	55.6	1.06	T.
Blue Lake	96	29	61.2	0.71	
Burnside	83	16	52.1	2.33	
Chesterfield	83	23	50.5	1.69	5.0
Downey	85	25	51.6	0.19	
Forney	85	17	47.0	1.45	8.5

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Idaho—Cont'd.	°	°	°	*Ins.*	*Ins.*
Garnet	103	29	62.8	0.16	
Grangeville	74	33	47.4	1.06	
Hailey	89	21	52.4	1.24	3.4
Lake	76	20	44.8	1.50	15.0
Lakeview	85	32	52.9	4.52	
Lost River [1]	90	20	50.8	0.61	T.
Moscow	83	30	52.4	3.28	0.8
Murray	88	28	51.0	5.10	
Oakley	98	24	54.3	0.10	
Ola	86	29	55.4	1.83	
Paris	82	20	53.4	0.70	
Payette	97	30	59.4	1.05	
Pollock	88	31	55.4	2.96	
Porthill	82	30	53.4	4.12	
Priest River	86	29	52.6	5.18	
Riddle	84	19	48.5	1.06	T.
St. Maries	87	35	54.1	3.78	
Silver City	85	19	48.2	1.99	10.5
Soldier	83	21	49.6	0.64	1.3
Vernon	86	18	51.3	1.08	
Weston	87	27	53.8	1.68	
Illinois.					
Albion	95	41	71.2	4.15	
Aledo	90	40	65.0	5.36	
Alexander	91	42	67.8	2.19	
Antioch	85	33	58.1	7.45	
Ashton	87	36	61.6	6.72	
Astoria	89	40	66.6	3.32	
Aurora	87	36	62.0	6.18	
Beardstown				1.73	
Benton	95	42	73.2	2.79	
Bloomington	94	39	67.8	2.07	
Bushnell	92	42	67.6		
Cambridge	91	40	65.0	4.38	
Carlinville	92	42	68.9	3.37	
Carrollton	91	44	69.2	2.23	
Centralia	95	40	72.0	1.98	
Charleston	90	44	69.0	3.46	
Chemung	84	33	59.1	5.30	
Chester				3.61	
Cisne	95	38	71.2	2.97	
Coatsburg	94	44	68.6	4.10	
Cobden	95	45	72.6	3.13	
Danville	88	48	71.6	2.60	
Decatur	92	41	68.0	2.80	
Dixon	89	38	63.6	8.00	
Dwight	90	35	65.0	5.72	
Effingham	95	40	72.4	4.02	
Equality	92	40	70.4	2.71	
Flora	90	40	68.8	1.55	
Friendgrove [23]	94	42	72.2	2.91	
Galva	89	39	64.8	5.01	
Grafton				1.41	
Greenville	95	44	70.4	2.63	
Griggsville	91	46	68.8	4.21	
Halfway	92	44	71.0	3.63	
Halliday	93	43	71.6	5.01	
Havana	92	41	68.7	2.57	
Henry	91	38	65.5	4.14	
Hillsboro	92	44	69.3	3.31	
Joliet	87	38	62.8	7.48	
Kishwaukee	89	36	61.7	7.88	
Knoxville	90	39	64.8	3.70	
Lagrange	87	36	61.6	6.16	
Laharpe	92	42	66.4	3.00	
Lanark	88	35	62.4	7.14	
Lasalle	99	37	67.5	4.36	
Loami				2.10	
McLeansboro	94	44	72.0	3.30	
Martinsville	91	37	69.5	2.87	
Martinton	88	37	62.5	4.51	
Mascoutah	94	43	69.0	3.15	
Mattoon	88	40	66.8	11.00	
Minonk	92	36	64.8	2.43	
Monmouth	91	38	64.6	3.65	
Morgan Park				7.84	
Morrison	87	41	64.0	6.48	
Morrisonville	91	45	68.3	1.02	
Mount Carmel				2.52	
Mount Pulaski	91	40	68.1	1.33	
Mount Vernon	96	44	71.4	5.14	
New Burnside	94	42	72.8	3.20	
Olney	96	40	71.6	1.85	
Ottawa	91	39	66.2	5.64	
Palestine	95	39	70.8	4.60	
Pana	93	43	68.9	1.71	
Paris	90	39	68.4	4.97	
Peoria *a*				3.03	
Peoria *b*	93	43	67.8	2.99	
Philo	90	36	66.2	2.23	
Plumhill	92	44	69.6	3.58	
Rantoul	91	38	66.4	3.29	
Raum	93	44	71.8	3.33	
Riley	87	35	60.2	6.16	
Robinson	92	38	69.0	3.10	
Rockford	91	36	63.0	8.30	
Rushville	90	45	68.0	2.72	
St. Charles [23]	90	40	65.0	7.90	
St. John	97	43	72.2	3.07	
Scales Mound	86	34	62.1	8.01	
Shobonier	93	38	69.8	2.04	
Strawn	89	37	64.6	3.59	
Streator	91	37	64.0	4.37	
Sullivan	90	41	68.2	3.22	
Sycamore	94	32	63.0	7.97	
Tilden	93	44	70.0	4.70	
Tiskilwa	88	37	63.6	5.05	
Tuscola	92	41	67.8	2.72	
Walnut	93	39	66.0	6.50	
Wellington	88	38	65.4	4.71	
Winchester	92	46	69.4	4.80	
Winnebago	85	35	61.6	7.62	
Yorkville	85	35	61.2	7.06	
Zion	88	36	63.2	4.69	
Indiana.					
Anderson	89	38	65.4	2.75	
Angola	88	33	60.2	5.28	
Auburn	91	33	60.6 [b]	3.81	
Bloomington	91	41	68.6	4.40	
Bluffton	93	32	63.3	2.88	
Butlerville	90	34	67.4	5.45	
Cambridge City	89	35	63.4	3.80	
Columbus	90	35	66.8	4.39	
Connersville	88	29	63.7	4.03	
Crawfordsville	92	37	68.6	3.63	
Delphi	92	36	64.6	3.42	
Edwardsville [21]	92	42	70.6	7.37	
Fairmount	94	32	63.3	1.78	
Farmland	89	36	63.5	3.51	
Fort Wayne	93	33	62.6	2.95	
Franklin [21]	92	48	67.6	5.32	
Greencastle	88	40	66.6	3.15	
Greensburg	92	33	67.6	2.18	
Hammond	87	34	57.3	6.89	
Hector	95	34	66.0	3.44	
Huntington	91	37	63.1	3.94	
Jeffersonville	93	41	70.3	6.68	
Knightstown	92 [d]	34 [d]	67.0 [d]	3.34	
Kokomo	89	37	65.2	3.08	
Lafayette	87	36	65.3	3.64	
Laporte	90	36	63.7	7.04	
Logansport	91	38	64.9	3.91	
Madison *a*	93	36	69.0	5.89	
Madison *b*				5.80	
Marengo	94	40	69.0	6.04	
Marion	92	34	64.6	2.59	
Markle	90	33	62.4	3.20	
Mauzy	89	34	65.0	6.09	
Moores Hill	90	30	66.0	6.80	
Mount Vernon	96	39	72.7	2.24	
Northfield	88	34	64.5	2.48	
Paoli	91	36	69.0	9.31	
Prairie Creek	92	35	69.2	1.55	
Princeton	93	37	71.0	3.30	
Rensselaer	91	37	64.2	2.81	
Richmond	91	33	65.2	3.35	
Rockville	89	37	67.6	3.59	
Salem	96	34	70.0	5.71	
Scottsburg	91	41	69.6	6.42	
Seymour	88	38	67.2	8.50	
South Bend	88	34	62.3	6.94	
Syracuse	94	33	62.8	4.50	
Terre Haute	93	42	70.4	2.88	
Topeka	85	32	59.6	5.78	
Valparaiso	87	36	62.6		
Veedersburg	91	34	67.4	2.68	
Vevay	91	41	69.0	5.25	
Vincennes	98	41	72.6	2.20	
Washington	98	38	72.0	4.47	
Winamac	89	31	62.9	5.67	
Worthington	92	36	69.3	5.30	
Indian Territory.					
Ardmore	98	52	73.1	9.86	
Bengal	97	37	71.2	6.10	
Chickasha	90	48	70.9	12.56	
Durant	94	52	73.0	8.70	
Fairland	89	46	70.6	3.99	
Goodwater	101	48	75.8	11.30	
Hartshorne	91	51	73.7	7.56	
Healdton	92	40	72.1	13.34	
Holdenville	89	41	70.2	7.66	
Marlow	93	51	70.1	12.24	
Muskogee	89	49	71.1	5.34	
Ryan	94	52	73.0	10.46	
South McAlester				8.84	
Tahlequah	93	45	72.0	3.42	
Tulsa				11.30	
Wagoner	95°	45°	74.4°	6.00	
Webbers Falls				6.70	
Iowa.					
Afton	90	40	66.0	7.31	
Albia	94	44	67.6	5.48	
Algona	87	38	62.8	5.40	
Alta	86	38	61.4	4.31	
Amana	91	42	64.7	5.30	
Ames *b*	88	41	64.2	6.69	
Atlantic	90	34	64.2	4.48	
Audubon	90	39	64.0	4.64	
Baxter	89	39	63.6	4.95	
Bedford	89	37	65.2	5.13	
Belknap	89	43	65.0	2.63	
Belleplaine	91	41	63.4	7.13	
Bonaparte	92	43	66.8	2.69	
Britt	88	37	62.0	6.36	
Buckingham				3.78	
Burlington	91	44	67.4	3.17	
Bussey				5.45	
Carroll	92	38	64.2	2.58	
Cedar Rapids	91	40	65.4	4.61	
Centerville	90	45	66.8	3.27	
Chariton	87	42	65.4	5.60	
Charles City	86	35	62.6	9.19	
Chester	88	35	60.6	14.62	
Clarinda	93	40	65.4	7.18	
Clearlake	91	35	62.4	6.85	
Clinton	92	39	65.6	6.04	
College Springs				7.86	
Columbus Junction	92	42	66.6	4.81	
Corning	89	42	64.6	5.87	
Council Bluffs	95	43	66.2	3.33	
Cresco	84	25	59.8	9.47	
Cumberland				2.26	
Danville				4.15	
Decorah	91	37	62.4	11.63	
Delaware	87	34	61.5	7.49	
Denison	87	37	62.8	2.69	
De Soto	89	44	67.2	3.26	
Dows	84	34	61.4	4.38	
Earlham	87	37	63.2	3.75	
Eldon	92	40	67.0	1.97	
Elkader	91	35	64.1	11.81	
Emerson				5.52	
Fairfield	92°	42°	66.2°	2.45	
Fayette	88	32	62.1	15.59	
Fonda				6.16	
Forest City	86	36	61.4	7.10	
Fort Dodge	88	36	63.4	2.89	
Fort Madison				4.37	
Galva	88	35	63.4	2.53	
Gilman				4.41	
Grand Meadow	88	32	61.6	18.04	
Greene	88	37	63.1	7.38	
Greenfield	87	40	63.8	6.76	
Grinnell	88	42	64.0	4.92	
Grundy Center	87	39	62.4	7.11	
Guthrie Center	87	37	60.2	3.30	
Hampton	88	37	62.4	7.45	
Harlan	88	39	64.0	3.31	
Hopeville				4.70	
Humboldt	90	37	63.1	3.51	
Independence	85	35	61.8	10.46	
Inwood				7.75	
Indianola	88	42	65.2	5.54	
Iowa City	95	40	66.3	3.75	
Iowa Falls	88	38	62.1	5.86	
Jefferson				4.68	
Keosauqua	93	40	67.8	2.14	
Lacona				7.20	
Lansing	88	33	63.0	11.36	
Larrabee	87	33	62.4	3.26	
Leclaire				5.17	
Lemars	86	34	62.6	1.46	
Lenox	87	41	64.4	4.71	
Leon	88	43	66.7	3.76	
Logan	90	41	65.4	2.88	
Maple Valley				3.68	
Maquoketa	89	37	65.5	5.73	
Marshalltown	91	41	64.8	7.65	
Monticello	89	35	64.6	5.81	
Mountayr	88	40	64.6	5.13	
Mount Pleasant	93	39	64.6	3.70	
Mount Vernon	92	36	64.5	4.49	
New Hampton	83	37	59.0	12.04	
Northwood	84	35	61.0	9.46	
Odebolt	88	37	64.2	2.30	
Ogden	89	40	64.0	6.61	
Olin	88°	40°	64.7°	5.59	
Onawa	89	39	66.4	1.48	
Osage	87	35	61.0	9.58	
Osceola	88 [g]	42	64.7 [4]	6.69	
Oskaloosa	84	42	63.6	3.72	
Ottumwa	91	46	67.4	3.90	
Ovid	88	40	64.8	4.83	
Pacific Junction	93	39	66.2	3.65	
Perry	90	40	65.6	6.25	
Plover	89	36	61.5	4.79	
Primghar	86	35	61.2	2.20	
Redoak	87	41	65.6	4.66	
Ridgeway	87	34	61.8	9.59	
Rockford				5.25	
Rockwell City	86	36	62.0	4.90	
Ruthven	87	36	60.6	6.31	
Sac City	88	39	63.6	3.63	
St. Charles	89	43	65.4	5.19	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Scranton	89	40	63.9	3.09	
Sheldon	87	32	60.8	4.81	
Sibley	88	35	60.8	2.56	
Sigourney	97	40	66.6	4.21	
Sioux Center	88	38	62.2	3.77	
Spirit Lake	85	37	60.5	4.95	
Stockport				2.88	
Storm Lake	82	37	60.9	4.22	
Stuart	90	40	65.4	6.12	
Thurman	91	39	66.5	4.61	
Tipton	88	40	64.7	5.85	
Villisca	91	40	65.3	5.11	
Vinton *1	88	40	64.0	6.64	
Wapello	88	41	65.5	3.27	
Washington	91	40	64.4	2.58	
Washta				0.87	
Waterloo	87	36	63.3	8.54	
Waverly	87	36	63.2	9.50	
Westbend	90	37	62.5	2.97	
Westbranch				3.97	
West Union				11.83	
Whitten	80	38	63.2	6.69	
Wilton Junction	92	40	64.2	4.85	
Winterset	87	40	64.3	5.19	
Woodburn				4.68	
Kansas.					
Abilene	94	40	65.2	5.45	
Achilles	97	36	62.7	6.00	
Anthony				10.39	
Atchison	92	45	69.0	6.76	
Baker	93	42	66.8	5.44	
Beloit	96[p]	43[p]	68.0[p]	5.10	
Burlington	90	43	70.0	6.44	
Clay Center	94	40	69.6	6.65	
Colby	97	38	64.4	3.46	
Columbus	90	44	70.8	8.38	
Coolidge	96	39	66.7	3.67	
Delphos	96	39	69.2	5.77	
Dresden	97	40	64.2	4.80	
Ellinwood	95	43	67.6	5.19	
Emporia	86	53	70.4	10.06	
Englewood	88	42	67.4	10.00	
Eureka				9.69	
Eureka Ranch	100	35	67.4	4.17	
Fallriver	89	44	69.4	9.18	
Farnsworth	98	39	66.2	3.00	
Forsha	91	42	68.4	3.45	
Fort Leavenworth	90	44	69.4	6.05	
Fort Scott	93	44	71.5	7.65	
Frankfort	95	40	68.2	5.46	
Fredonia	86	45	69.4	11.40	
Garden City	99	40	67.6	6.26	
Gove *1	97	40	63.3	3.06	
Grenola	89	44	69.6	10.57	
Hanover	95	42	68.2	4.86	
Harrison	98	40	66.8	6.17	
Hays	101	40	67.2	4.28	
Horton	93	43	67.8	6.43	
Hoxie	98	39	66.3	4.27	
Hutchinson	98	38	68.0	8.98	
Independence	92	47	72.2	9.63	
Jetmore	98	40	67.4	3.97	
Lakin	97	39	66.7	4.72	
Lebanon	99	37	67.4	3.50	
Lebo	89	45	70.0	10.29	
Leoti	98	38	67.2	3.27	
Little River	95	41	69.0	6.29	
Macksville	95	42	66.8	6.26	
McPherson	95	42	69.6	7.01	
Madison				8.75	
Manhattan	94	41	70.0	7.30	
Marion	92	42	70.2	10.15	
Meade	98	40	69.8	7.17	
Medicine Lodge	95	42	70.6	9.68	
Minneapolis	95	41	69.0	4.52	
Moran	92	45	70.4	7.45	
Mounthope *1	90	50	69.5	7.24	
Ness City	100	42	69.0	2.37	
Norwich	90	45	69.0	8.87	
Oberlin				4.89	
Olathe	89	41	68.7	4.48	
Osage City	89	40	69.1	7.68	
Oswego	88	45	70.6	8.32	
Ottawa	95	39	69.2	4.67	
Paola	92	42	69.4	10.04	
Phillipsburg		40		3.39	
Pratt	93	42	67.4	9.14	
Rome	92	42	69.4	10.88	
Salina	95	40	69.6	5.19	
Sedan	89	46	70.4	9.65	
Seneca	92	42	67.9	4.08	
Toronto	89	42	69.6	10.42	
Ulysses	96	38	65.8	3.46	
Valley Falls	91	39	68.6	9.22	
Viroqua	94	40	65.9	4.28	
Wakeeney				5.66	
Wallace *1	95	38	66.5	4.80	
Wamego *1	91	49	68.2	6.78	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Winfield	90	45	69.5	9.87	
Yates Center	90	46	71.0	10.28	
Kentucky.					
Alpha	93	42	70.2	2.42	
Anchorage	90	35	68.8	5.90	
Bardstown	94	38	70.6	3.35	
Berea	91	38	69.2	2.77	
Blandville	92	46	72.0	2.20	
Bowling Green	96	39	70.6	3.82	
Burnside	96	40	71.0	1.60	
Carrollton	93	44	71.4	3.62	
Catlettsburg				4.58	
Centertown	94	38	70.8	2.17	
Earlington	93	41	71.6	3.23	
Edmonton	92	36	69.8	2.77	
Eubank	90	37	67.2	2.33	
Falmouth				5.50	
Fords Ferry	90[l]	40	70.0[f]	4.15	
Frankfort	90	40	68.8	6.53	
Franklin	91	40	71.3	1.65	
Georgetown	91	42	69.2		
Greensburg	94	37	69.1	2.42	
Henderson	96	41	73.3	1.37	
High Bridge	91			3.38	
Hopkinsville	98	41	72.8	4.81	
Irvington	96	36	70.7	2.75	
Leitchfield	93	41	69.3	2.94	
Loretto	91	37	68.6	3.79	
Manchester	93[e]	39[e]	68.9[e]	2.48	
Marrowbone	92	36	68.6	2.46	
Mayfield	92	46	73.5	2.74	
Maysville	93	39	68.0	4.05	
Mount Sterling	90	39	68.0	3.87	
Owensboro	94	43	71.4	2.73	
Owenton	93	39	67.4	5.17	
Paducah *a*				2.63	
Paducah *b*	98	49	75.2	2.35	
Pikeville	93	39	70.2	2.59	
Princeton	91	41	69.4		
Richmond	96	37	68.3	3.24	
St. John	91	37	69.0	3.73	
Scott	89	39	67.3	5.58	
Shelby City	92	39	68.4	3.44	
Shelbyville	97	39	69.9	5.14	
Taylorsville	91	39	68.3	5.62	
Warfield	91	37	66.6	2.53	
Williamsburg	93	40	70.0	3.17	
Louisiana.					
Abbeville	90	64	76.7	6.07	
Alexandria	96	55	77.9	9.09	
Amite	97	54	77.4	1.45	
Baton Rouge	94	60	77.3	2.60	
Burnside	95	61	77.6	3.62	
Calhoun	92[l]	52	73.9[f]	3.21	
Cameron	88	64	77.6	4.12	
Cheneyville	95	57	77.4	5.40	
Clinton	93	55	76.6	2.89	
Collinston	98	53	76.6	3.81	
Covington	98	56	78.2	1.72	
Donaldsonville	92	63	76.8	3.75	
Emilie	93	63	77.2	2.07	
Farmerville	91	46	72.3	4.89	
Franklin	95	62	78.4	5.98	
Grand Coteau	94	59	77.7	1.80	
Hammond	95	55	77.8	3.25	
Houma	95	61	78.0	4.38	
Jennings	94[j]	61[b]	77.0[f]	3.66	
Lafayette	98	59	77.6	1.98	
Lake Charles	91	62	76.8	6.08	
Lake Providence	93	56	75.8	2.56	
Lakeside	91	55	76.8	5.71	
Lawreuce	94	63	78.2	3.27	
Libertyhill	95	53	76.0	3.55	
Mansfield	93	51	74.4	2.55	
Melville [k]	94	61	78.2	3.15	
Minden	95	53	74.6	4.89	
Monroe	92	56	75.9	1.38	
New Iberia	90	64	77.1	5.00	
Opelousas	95	57	76.9	2.75	
Oxford	95	50	74.3	2.03	
Paincourtville	94	61	77.5	5.45	
Plain Dealing	95[f]	51[f]	76.0[f]	7.05	
Rayne	95	61	78.2	3.61	
Reserve	96	63	78.4	2.34	
Robelin	95	55	76.6	2.55	
Ruddock	95	67	78.4	1.46	
Ruston	93[f]	53[f]	74.6[f]	5.46	
Schriever	95	58	77.1	4.80	
Southern University				0.14	
Sugar Experiment Station	94	65	78.2	1.49	
Sugartown	91	61	78.0	2.77	
Venice	85	60	73.8	2.74	
Wallace	96	63	79.0	2.81	
Maine.					
Bar Harbor	85	29	51.5	2.52	
Belfast	89	29	51.4	1.85	
Bemis	67	28	46.4	4.15	
Calais	83	30	51.4	4.37	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Maine—Cont'd.	°	°	°	*Ins.*	*Ins.*
Carmel	84	26	51.0	2.94	
Cornish	87	26	54.3	3.05	
Fairfield	86	28	53.3	2.54	
Farmington	86	25	53.0	5.16	
Fort Fairfield	80	20	45.8	2.10	8.0
Gardiner	88	29	54.6	2.01	
Houlton	75	25	49.1	2.87	T.
Kineo	68[e]	24[e]	47.6[e]	4.67	
Lewiston	87	31	54.5	2.67	
Mayfield	80	24	49.6	3.40	T.
North Bridgton	88	26	54.0	3.98	
Orono	83	28	50.7	2.77	
Patten	82	21	48.5	3.52	
Roach River				3.56	
Rumford Falls	84	24	51.0	5.32	
The Forks				4.62	
Vanburen	81	20	48.0	4.42	2.0
Winslow				2.24	
Maryland.					
Annapolis	91			2.42	
Bachmans Valley	89	35	60.3	1.46	
Boettcherville	98	33	66.8	1.90	
Boonsboro	90	34	64.9	1.97	
Cambridge	93	45	66.0	2.93	
Charlotte Hall	90[f]	38[f]	64.0[f]	3.69	
Chase	91	33	63.3	1.17	
Cheltenham	90	36	63.5	2.06	
Chestertown	86	40	63.2	2.21	
Chewsville	91	29	62.6	1.26	
Clearspring	91	34	63.4	1.88	
Coleman	90	42	63.8	1.55	
Collegepark	91	35	63.9	2.70	
Colora				1.29	
Cumberland *b*				1.32	
Darlington	93	37	63.0	1.89	
Deerpark	87	22	59.4	4.76	T.
Denton	89	38	62.8	1.94	
Easton	87	42	64.4	1.62	
Fallston	90	36	62.2	0.94	
Frederick	93	38	66.4	1.08	
Grantsville	86	26	59.0	3.64	T.
Greatfalls	96	37	66.8	1.11	
Greenspring Furnace	94	34	64.2	1.47	
Guard	88	30	63.2	4.04	
Hancock	95	33	64.3	2.63	
Harney				0.82	
Jewell	88	40	64.1	2.29	
Johns Hopkins Hospital	90	41	64.6	1.77	
Laurel	93	35	63.2	1.88	
McDonogh	89	32	62.7	1.02	
Mount St. Marys College	90	37	63.8	0.98	
Newmarket	90	37	64.7	0.97	
Princess Anne	85	36	62.2	2.15	
Smithsburg *b*	91	34	64.4	1.42	
Solomons	92	46	65.8	2.82	
Sudlersville	92	39	65.0	2.28	
Sunnyside	87	24	59.0	4.36	T.
Takoma Park	92	37	64.6	2.64	
Taneytown	93	36	62.8	0.73	
Van Bibber	87	40	63.1	1.19	
Westernport	94	32	64.0	2.88	
Woodstock	92	38	66.0	1.04	
Massachusetts.					
Amherst	85[e]	29[d]	56.8[d]	2.42	
Bedford	84	34	56.6	2.66	
Bluehill (summit)	88	31	56.1	1.38	
Chestnuthill	89	33	58.0	1.20	
Cohasset				1.11	
Concord	89	31	56.0	2.39	
East Templeton *1	86	32	55.3	1.96	
Fallriver	78	36	56.0	1.02	
Fitchburg *a* *1	85	34	56.1	2.31	
Fitchburg *b*	88	30	56.4	2.69	
Framingham	89	33	58.0	1.79	
Groton	86	30	55.4	2.09	
Hyannis				1.13	
Jefferson				1.60	
Lawrence	89	32	57.2	2.41	
Leominster				2.84	
Lowell *a*	86	32	58.8	2.37	
Ludlow Center	86	26	53.0	1.72	
Middleboro	83	29	55.4	1.13	
Monson	87	25	54.8	2.61	
New Bedford *a*	72	37	56.0	1.36	
Plymouth *1	64	48	55.6	1.52	
Princeton				2.98	
Provincetown	70	36	54.4	1.28	
Salem				1.25	
Somerset *1	85	34	59.0	1.04	
Springfield Armory	91	31	57.9	1.40	
Sterling				2.61	
Taunton *c*	80	29	55.0	1.41	
Webster				1.60	
Westboro	89	33	59.2	1.53	
Weston	87	32	56.4	1.59	
Williamstown	83	28	54.7	3.30	
Winchendon				2.88	
Worcester	88	31	57.6	1.64	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Michigan.	°	°	°	*Ins.*	*Ins.*
Adrian	88	34	59.6	3.72	T.
Agricultural College	87	30	58.4	4.92	2.0
Allegan	92	30	60.2	5.12	2.0
Alma	96	29	57.5	3.13	T.
Ann Arbor	90	31	58.6	4.72	3.5
Annpere	89	40	59.8	2.70	
Arbela	89	27	58.0	5.77	T.
Baldwin	90	29	57.2	4.78	
Ball Mountain	88	30	57.3	5.94	T.
Baraga	72	40			
Battlecreek	89	30	59.8	4.36	0.2
Bay City	89	23	56.8	4.32	
Benzonia	83	27	53.6	3.25	T.
Berlin	86	27	55.5	4.00	T.
Berrien Springs	90	34	61.2	4.67	T.
Big Rapids	90	28	55.9	4.45	T.
Birmingham	91	30	58.4	2.44	
Boon	86	22	52.3	4.08	T.
Calumet	78	22	49.9	3.07	T.
Cassopolis	87	32	59.6	5.20	
Charlevoix	75	29	49.0	2.41	
Charlotte	90	31	59.4	5.57	6.0
Chatham	87	22	49.4	2.11	
Cheboygan	78	25	50.0	2.05	
Clinton	91	32	60.8	5.79	1.5
Coldwater	90	31	59.4	4.73	
Deerpark	84	29	48.4	1.85	
Detour	75	30	48.6	2.78	T.
Dundee	88	33	58.7	4.11	
Eagle Harbor	76	27	47.2	3.88	
East Tawas	85	23	53.1	2.24	
Eloise	90	31	58.7	4.61	T.
Ewen	90	29	53.5	0.70	
Fennville	87	32	59.2	4.70	2.0
Fitchburg	88	28	57.2	5.79	5.5
Flint	88	29	57.2	3.96	T.
Frankfort	73	41	57.2	4.50	
Gaylord	82	21	51.8	8.80	T.
Grand Rapids	84	31	58.8	5.61	5.5
Grape	90	32	58.0	5.54	T.
Grayling	85	24	53.2	4.70	T.
Hanover	88	32	58.7	7.13	1.0
Harbor Beach	87	27	53.2	2.91	
Harrison	88	26	56.0	3.47	
Harrisville	89	21	50.2	2.81	T.
Hart	87	31	56.8	4.23	2.0
Hastings	89	30	59.2	5.72	3.0
Hayes	86	25	54.0	2.34	
Highland Station				4.21	1.5
Hillsdale	89	31	59.2	4.61	
Humboldt	84	14	50.0	2.29	T.
Ionia	88	32	61.2	3.00	1.0
Iron Mountain	89	26	54.0	2.53	T.
Iron River	90	23	53.6	2.10	T.
Ironwood	80	28	52.8	1.31	T.
Ishpeming	82	24	50.8	3.15	T.
Ivan	86	24	53.4	3.46	T.
Jackson	90	33	61.0	5.88	1.0
Jeddo	86	28	55.2	6.63	
Kalamazoo	89	33	63.6	3.44	T.
Lake City	82	23	57.8	2.05	
Lansing	88	32	58.8	4.39	4.0
Lincoln	84	24	54.4	2.86	
Ludington	82	29	53.8	3.97	0.3
Mackinac Island	71	23	48.0	2.18	
Mackinaw	78	30	54.4	2.64	
Mancelona	85	26	23.9	4.37	
Manistee	82	32	55.2	5.74	T.
Manistique	70	28	48.3	3.52	
Menominee	84	21	52.0	2.62	T.
Midland	91	28	58.3	3.43	T.
Mio	86	21	52.2	2.31	
Mount Clemens				1.50	
Mount Pleasant	90	28	57.7	3.96	T.
Muskegon	84	32	58.0	4.46	4.0
Newberry	80	15	50.1	1.01	
North Marshall	90	32	59.2	3.80	3.0
Old Mission	84	30	53.7	4.22	
Olivet	86	32	58.6	3.43	3.2
Omer	78	24	52.8	4.15	
Onaway	83	26	53.2	2.83	T.
Ovid	87	30	57.8	4.26	1.3
Owosso	90	32	59.6	4.60	
Petoskey	85	28	51.4	1.24	
Plymouth	92	40	63.6		
Port Austin	85	27	55.1	3.80	
Reed City	90	29	57.6	5.26	T.
Saginaw	91	28	58.0	5.16	T.
St. Ignace	71	29	50.5	2.44	
St. Johns	88	31	59.0	4.68	0.8
St. Joseph	86	37	59.2	5.51	
Somerset [1]	88	30	60.4	3.84	
South Haven	82	30	56.3	4.19	T.
Stanton	92	20	60.6	4.72	
Thomaston	90	23	53.2	1.31	T.
Thornville	87	35	58.5	4.35	5.0
Traverse City	82	24	53.0	3.30	
Vassar	72	30	53.2	1.78	
Wasepi	87	33	60.2	6.13	T.
Waverly	88	30	58.2	3.90	2.0
Webberville	88	31	58.5	4.83	2.0
West Branch	81	24	55.0	4.64	
Wetmore	85	20	49.7		
Whitecloud	87	29	56.6	2.25	T.
Whitefish Point	70	27	45.1	1.88	
Ypsilanti	87	29	57.6	5.73	3.5
Minnesota.					
Ada				3.75	T.
Albert Lea	85		61.0[f]	9.39	
Alexandria	85	23	55.0	5.79	1.0
Angus	84	29	55.5	2.85	1.1
Ashby	83[x]	33[x]	57.2[x]	4.69	T.
Beardsley	86	29	58.2	3.99	
Beaulieu	86[x]	29[x]	56.6[x]	3.19	2.0
Bemidji	83	28	56.3	3.93	
Bird Island	86	37	59.8	3.42	T.
Blooming Prairie	84	33	59.3	8.05	
Brainerd	84	29	58.0	6.59	
Caledonia	85	30	59.8	11.13	T.
Campbell	89	33	58.2	3.31	
Collegeville	85	31	58.5	3.00	3.0
Crookston	84	31	57.3	3.25	1.0
Currie	84	33	59.4		
Deephaven				3.86	
Detroit City	84	29	56.7	6.57	
Faribault	86	34	59.8	5.16	
Farmington	86	33	60.3	6.41	
Fergus Falls	86	32	57.6	4.06	0.5
Grand Meadow	85	33	63.0	10.94	
Hovland				3.29	T.
Lake Winnibigoshish	83	23	54.5	5.59	1.8
Leech	88	26	54.4	5.52	4.0
Long Prairie	89	30	58.8	6.48	
Luverne	79	37	57.2	4.43	
Lynd	90	30	61.0	3.47	
Mapleplain	88	32	59.3	3.54	
Milaca	85	28	56.8	3.79	
Milan	86	34	58.2	4.09	
Minneapolis [b1]	87*	34	59.8	4.32	
Montevideo	84	33	57.8	3.40	
Morris	88	34	59.0	4.26	
Mount Iron	85	28	54.4	6.08	
New London	86	33	58.7	3.17	
New Richland	88	33	61.0	5.32	
New Ulm	88	37	61.4	3.18	
Park Rapids	82	28	54.6	6.22	4.8
Pine River	81	27	54.3	10.83	3.0
Pipestone	83	34	58.0	4.76	
Pleasant Mounds	85	37	60.1	5.24	
Pokegama Falls	95	22	56.0	5.03	4.5
Redwing [a]				6.75	
Reeds				8.28	
Rolling Green	83	37	60.5	4.55	
St. Cloud	86	32	59.5	2.79	T.
St. Peter	87	36	61.2	3.17	
Sandy Lake Dam	84	29	54.9	6.18	2.5
Shakopee	86	35	60.4	5.24	
Tower	84	23	53.2	7.50	3.0
Two Harbors	86	26	47.2	4.08	0.5
Wabasha	88	33	61.6	8.22	
Warroad	80	17	45.8	0.65	
Willmar	85	33	58.2	3.70	T.
Willow River	87	26	59.7	3.87	4.3
Winnebago City	89	35	62.0	5.56	
Winona	86	34	61.9	9.19	
Worthington	87	36	58.8	3.45	
Zumbrota [1c]	84*	38	61.0		
Mississippi.					
Aberdeen	100	48	73.6	1.59	
Agricultural College	94[d]	52	76.4	1.48	
Austin	93	50	74.2	5.48	
Batesville	96	48	75.2	1.56	
Bay St. Louis	92	64	78.5	3.08	
Biloxi	93	64	78.6	2.23	
Booneville	92	47	74.1	1.65	
Brookhaven	96	54	76.2	3.20	
Canton	95	53	75.6	3.93	
Columbus [b]	94	54	75.2	1.19	
Corinth	94	45	73.6	0.58	
Crystalsprings	94	56	76.4	3.53	
Duck Hill	97*	48*	76.0*	0.76	
Edwards	95	54	76.4	4.37	
Fayette [f]	92	52	75.2	3.85	
Fayette (near) [e4]	91	61	78.7	3.95	
Greenville [a]	90	58	75.0	4.57	
Greenville [b]	99	57	77.4	4.60	
Greenwood	97	52	76.1	2.32	
Hattiesburg	98	53	77.6	3.95	
Hazlehurst	96	55	75.9	4.10	
Hernando	92	50	73.5	2.35	
Holly Springs	94	49	74.6	2.44	
Indianola	96	52	76.3	3.30	
Jackson	98	53	77.2	4.19	
Kosciusko	96	53	76.5	1.05	
Lake	95	53	75.0	2.63	
Leakesville	99	55	76.8	4.63	
Louisville	94	52	75.2	2.11	
Macon	98	52	78.3	0.78	
Magnolia	96	51	76.1	2.45	
Natchez	95	58	78.0	3.55	
Nittayuma	96	57	76.8	5.20	
Okolona	99	51	79.2	1.33	
Palo Alto	95	51	76.8	0.49	
Patmos				2.32	
Pearlington	95	58	76.9	6.82	
Pittsboro	96	49	75.7	0.65	
Pontotoc	93	49	75.3	0.81	
Port Gibson	97	51	77.0	3.04	
Ripley	96	47	75.8	3.14	
Shoccoe				1.41	
Stonington [e1]	92	56	76.2	3.18	
Suffolk	94	53	75.6	5.01	
Swartwout	97	59	76.6	4.18	
Thornton	94	60	78.0	2.70	
Tupelo	98	48	75.8	0.78	
University	95	50	74.6	2.53	
Walnutgrove	92[j]	50[j]	73.6[j]	2.14	
Watervalley	96	51	76.4	3.70	
Waynesboro	96	54	76.8	2.73	
Woodville	95	56	77.6	2.49	
Yazoo City	98	51	76.9	3.00	
Missouri.					
Appleton City	95	46	70.1	8.43	
Arthur	90	43	70.4	6.88	
Avalon	90	41	68.0	6.46	
Bagnell				4.64	
Bethany	89	41	66.4	8.30	
Birchtree	92[e]	47[e]	70.4[e]	2.99	
Boonville				4.95	
Brunswick	91	46	68.5	4.68	
Conception	84	44	65.4	7.00	
Cowgill [e5]	90	48	69.6	7.01	
Darksville	90	44	68.2	6.80	
Dean	90[e]	45	71.2	4.20	
Desoto	92	44	68.9	5.03	
Downing				2.16	
Edgehill [e5]	94	50	71.8	3.02	
Edwards	91	41	70.2	5.99	
Eightmile [e2]		44	66.0	4.16	
Eldon	91	42	69.4	3.73	
Fairport				7.55	
Fayette	91	46	68.2	5.14	
Fulton	92	43	69.2	4.42	
Galena				5.32	
Gallatin [e1]	90	46	66.4	6.80	
Glasgow	91	47	68.6	4.10	
Gorin				2.54	
Grant City				6.70	
Halfway	94	45	69.9	7.05	
Harrisonville	92	44	69.3	4.02	
Hazlehurst				5.84	
Hermann				4.12	
Houston	93	42	70.8	5.21	
Ironton	96	39	71.4	2.37	
Jackson	92	44	72.1	1.80	
Jefferson City	94	44	70.2	3.14	
Joplin	89	47	71.4	6.25	
Kidder	90	42	67.0	8.55	
Koshkonong	91	49	71.4	3.79	
Lamar	91	46	71.7	8.02	
Lamonte				5.17	
Lebanon	90	45	70.4	7.16	
Lexington	91	44	69.0	7.22	
Liberty	91	42	68.6	5.93	
Louisiana	92	41	67.9	4.93	
Macon	93	43	68.8	5.44	
Marblehill	93	40	72.0	1.64	
Marshall	92	45	68.2	4.45	
Maryville	91	44	65.0	5.71	
Mexico	94	44	68.8	4.21	
Miami [e5]	91	49	71.2	3.74	
Mineralspring	89	41	70.2	4.75	
Monroe City	94	44	68.0	4.66	
Montreal	91	40	69.2	4.72	
Mountaingrove	88	42	69.0	3.00	
Mount Vernon	93	42	71.9	7.88	
Neosho	88	42	70.8	4.95	
Nevada				9.60	
New Haven	95	46	70.9	2.22	
New Madrid [b]				2.48	
New Palestine	91	46	69.0	5.17	
Oakfield	92	46	70.0	5.89	
Olden	90	47	70.8	4.40	
Oregon	91	44	67.6	6.42	
Palmyra [e5]	92	46	68.9	5.82	
Phillipsburg				4.74	
Pine Hill				3.30	
Poplarbluff	98	45	74.1	1.95	
Potosi	92	39	68.5	4.43	
Princeton	94	44	68.2	8.58	
Richmond	89	44	67.9	5.24	
Rockport				5.73	
Rolla				5.96	
St. Charles	93	45	70.0	3.52	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
St. Joseph				6.46	
Sarcoxie *3		50	66.8	5.29	
Sedalia	90	46	69.6	5.30	
Seymour	87	46	68.7	4.86	
Shelbina				4.77	
Sikeston	92	43	72.1	2.23	
Steffenville	95	45	68.6	6.32	
Sublett	93	41	68.0	3.62	
Trenton	89	45	67.6	4.28	
Unionville	94	40	68.1	3.92	
Vichy	92	41	69.6	5.48	
Warrensburg	92	45	69.8	4.83	
Warrenton	94	45	69.6	1.83	
Wheatland				9.93	
Willowsprings	90	43	69.9	6.46	
Windsor	90	42	70.3	5.39	
Zeitonia	94	42	72.0	2.81	
Montana.					
Adel	81	21	48.3	4.45	5.0
Anaconda	85	26	49.8	0.86	
Augusta	86	25	50.8	4.16	2.5
Billings	94	30	60.0		
Boulder	81	27	50.8	2.38	
Bozeman	82	26	51.6	3.90	
Canyon Ferry	88	29	54.8	4.76	T.
Chester	90	17	53.7	0.58	
Columbia Falls	86	24	50.7	6.57	6.0
Crow Agency	86	26	59.2	3.03	
Culbertson	86	28	55.0	3.01	
Deerlodge	82	26	51.7		
Dell	84	20	49.2	0.42	
Dillon	78	24	52.1	2.47	T.
Ekalaka	83	22	56.0	3.42	
Fort Benton	88	30	54.0		
Fort Logan	84	28	47.4	3.21	
Glendive	92	30	58.1	4.81	
Greatfalls	86	30	56.2	5.93	
Kipp	80	20	48.8	5.95	
Lewistown	88	25	52.4	4.00	
Livingston	92	30	56.0	0.76	
Manhattan	85	27	54.2	3.90	
Marysville	85	28	50.7	4.55	1.1
Missoula	88	33	54.4	4.53	T.
Ovando	85	28	49.0	5.28	1.7
Parrot	84	27	53.0	2.69	
Plains	86	30	52.8	3.47	
Poplar	91	30	58.5	3.12	
Ridgelawn	88	29	57.8	2.85	
St. Pauls	86	27	53.4	5.63	1.0
St. Peter	80	23	48.8	6.64	8.0
Toston	85	22	53.0	3.17	
Troy	91	27	53.1	3.64	
Twin Bridges	85	25	52.8	3.70	
Twodot	86	25	52.4	2.85	
Utica	91	26	55.2	1.41	
Wibaux	85	29	55.0	3.33	
Yale	86	25	52.2	1.20	
Nebraska.					
Agate				1.58	
Agee *1	89	38	61.3	1.60	
Albion	90	38	62.6	3.59	
Alliance	90	32	62.6	1.20	
Alma	100	42	66.8	6.61	
Ames	91	38	66.4	2.91	
Ansley	90	41	65.6	4.41	
Arapahoe *1				5.72	
Arborville *1	90	44	64.5	5.79	
Arcadia				6.74	
Ashland *a*	95	40	66.9	3.22	
Ashland *b* *1	94	47	67.8	3.48	
Ashton				5.60	
Auburn	95	40	67.0	7.23	
Aurora	92	40	64.1	5.95	
Bartley				5.80	
Beatrice	96	38	66.4	5.68	
Beaver	98	40	64.9	5.82	
Bellevue				3.86	
Benedict				7.10	
Benkleman				7.77	
Blair	88	41	62.8	2.63	
Bluehill *1	91	45	66.8	3.57	
Bradshaw				7.83	
Bridgeport	88	30	60.5	2.93	
Brokenbow	90	40	63.1	5.59	
Burchard				5.64	
Burwell				4.45	
Callaway	87	41	62.0	6.25	
Central City				5.63	
Chester				6.11	
Cody				1.76	
Columbus	89	39	64.3	3.64	
Crete	92	40	65.6	4.77	
Culbertson				4.27	
Curtis	92	35	63.6	4.81	
Dannebrog				5.60	
Dawson	93	41	67.4	5.34	
Edgar				4.98	
Ericson				4.45	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ewing				2.01	
Fairbury	97	37	65.4	5.04	
Fairmont	96	38	64.0	7.51	
Fort Robinson	89	28	58.2	2.56	
Franklin	102	41	65.4	3.92	
Fremont	88	38	65.0	2.36	
Fullerton				5.67	
Geneva	94	39	65.8	5.26	
Genoa	90	40	64.2	4.55	
Gering	90	32	59.4	2.44	
Gosper				6.50	
Gothenburg	90	37	62.4	6.83	
Grand Island *a*				4.77	
Grand Island *b*	95	40	64.8	5.47	
Grand Island *c*	90	40	64.0	5.02	
Greeley				5.08	
Guide Rock	96	40	66.2	4.11	
Haigler				5.68	
Hartington	86	37	62.7	2.76	
Harvard	95	38	64.1	7.01	
Hastings *1	92	50	64.8	7.57	
Hayes Center				6.02	
Hay Springs	85	29	57.5	2.00	
Hebron	95	40	66.2	4.19	
Holbrook				4.48	
Holdrege	98	41	64.0	10.08	
Hooper *1	90	44	65.5	2.74	
Imperial	87	40	62.2	3.58	
Johnstown				1.37	
Kearney	96	42	65.6	5.42	
Kennedy	91	34	61.6	3.65	
Kimball	89	31	58.4	1.94	
Kirkwood *1	86	39	60.5	2.69	
Laclede	91	37	63.8	4.44	
Lexington	92	40	61.6	5.72	
Lodgepole	82	31	58.9	1.20	
Loup	92	40	62.6	5.85	
Lynch				1.57	
Lyons				0.75	
McCook *1	92	42	61.7	6.50	
McCool				6.13	
Madison	88	38	63.2	3.43	
Madrid	90	35	62.4	4.25	
Marquette				5.14	
Mason City				3.83	
Minden *a*	97	40	63.2	8.73	
Monroe				3.95	
Nebraska City *b* *1	90	46	64.7	5.12	
Nemaha *1	94	50	70.6	5.40	
Nesbit	86	35	60.9	5.13	
Norfolk	89	37	64.7	3.25	
North Loup	93	39	63.4	5.06	
Oakdale	89	35	63.1	2.56	
Odell				5.16	
O'Neill	88	35	61.0	2.32	
Ord				5.89	
Osceola				5.23	
Palmer				4.65	
Palmyra *1	92	46	65.3	5.42	
Plattsmouth *a*	93	42	65.0	4.95	
Purdum	86	36	61.7	2.64	
Ravenna *a*	92	42	63.6	6.82	
Ravenna *b*				6.28	
Redcloud *b*				3.80	
Republican *1	98	50	68.9	4.85	
Rulo				7.53	
St. Libory				6.00	
St. Paul	92	40	65.1	5.65	
Salem *1	94	52	70.4	4.31	
Santee	92	37	64.5	1.35	
Schuyler				3.20	
Seneca *1	88	45	63.7		
Seward	92	40	64.4	2.51	
Smithfield				7.80	
Spragg				2.96	
Springview	82	37	60.7	2.64	
Stanton	89	35	64.6	1.85	
State Farm	95	39	66.5	3.50	
Strang *1	92	48	67.1	5.13	
Stratton				5.31	
Syracuse				7.15	
Tablerock	96	41	65.6	5.60	
Tecumseh *b*	95	38	66.2	5.58	
Tekamah	90	39	66.4	1.36	
Turlington	94	42	65.6	6.39	
Wakefield	87	34	63.3	1.35	
Wallace				3.10	
Waunets				4.47	
Weeping Water				3.93	
Westpoint	89	37	65.2	1.38	
Wilber *1	92	42	65.5	7.05	
Willard				5.44	
Wilsonville	92	46	68.4	6.44	
Winnebago				1.92	
Wisner				0.98	
Wymore				5.27	
York	92	40	67.1	5.81	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nevada.	°	°	°	*Ins.*	*Ins.*
Austin	79	23	50.4	0.98	
Battle Mountain *h*	93	28	59.8	0.25	
Belmont	77	22	47.1	0.01	
Beowawe *1	85	36	55.3	0.80	
Butler	86	22	53.3	T.	T.
Candelaria	89	27	57.4	0.10	T.
Carlin				0.20	
Carson City	85	22	51.8	0.28	0.7
Cranes Ranch				0.32	
Elko (near)	84	27	50.2		
Ely	85	21	52.0	0.39	
Eureka	83	22	52.6	0.90	6.0
Fenelon *1	80	35	54.0	0.00	
Golconda *1	90	30	60.0	T.	
Halleck *1	84	33	53.4	T.	
Hamilton	79	20	50.4	0.20	2.0
Hawthorne	85	31	56.6	0.00	
Humboldt	92	25	57.7	0.10	
Lee				1.46	
Lewers Ranch	87	24	52.2	1.00	0.5
Lovelocks *a*	100	28	62.0	0.00	
Martins	86	21	53.6	0.00	
Mill City *1	85	32	54.2	0.15	
Monitor Mill	80	16	50.0	0.35	0.2
Palisade	86	29	54.0	0.08	
Palmetto	84	18	50.4	1.11	1.0
Potts	88				1.5
Reno State University		30		T.	
Rioville	102	50	75.6	T.	
Silverpeak	90	36	58.2	T.	
Sodaville	94	30	60.0	0.15	
Tecoma	91	29	58.2	0.17	
Toano *1	83	32	58.6	0.06	
Verdi *5	78			T.	
Wabuska	88	23	54.5	T.	
Wadsworth	88	23	57.5	1.33	
Wells *1	82	28	54.2		
Wood	86	20	51.8	0.36	
New Hampshire.					
Alstead	84	28	54.5	4.36	
Berlin Mills	85	20	50.0	4.00	T.
Bethlehem	82	20	50.9	5.07	T.
Brookline *1	90	28	57.0	2.33	
Chatham	86	23	51.0	5.15	
Claremont	85	30	54.8	2.41	
Concord	87	27	55.0	2.38	
Durham	88	30	54.8	1.22	
Franklin Falls	85	26	53.9	2.22	
Grafton	87	23	51.9	3.69	
Hanover	86	25	53.2	3.57	T.
Keene	88	26	54.6	3.40	
Littleton	81	17	47.8	5.73	T.
Nashua	92	30	57.7	3.08	
Newton	88	28	54.4	2.30	
Peterboro	86	24	53.7	2.52	
Plymouth	90	26	53.8	3.02	
Sanbornton	85	26	52.9	2.78	
Stratford	84	22	51.6	5.43	0.5
New Jersey.					
Asbury Park	84	37	58.6	1.40	
Bayonne	90	38	60.6	1.33	T.
Belvidere	91	35	61.0	1.48	
Bergen Point	89	35	59.8	1.31	T.
Beverly	91	37	62.2	2.10	
Blairstown	93	33	59.4	1.86	
Bridgeton	95	38	64.2	1.70	
Camden	89	40	62.7	2.50	
Cape May C. H.	85	37	60.7	1.94	
Charlotteburg	88	30	57.6	2.31	
Chester	89	33	57.5	2.70	
Clayton	91	35	62.0	1.71	
College Farm	90	36	61.1	1.51	
Culvers Lake				3.57	
Dover	92	34	58.0	2.17	
Egg Harbor City	92	34	61.0	1.72	
Elizabeth	93	37	61.6	1.89	
Englewood	89	36	60.4	1.66	
Flemington	91	35	61.2	2.05	
Freehold	87	36	58.9	1.92	
Friesburg	90	35	61.6	1.52	
Hanover	91	34	58.5	3.50	
Hightstown	89	38	61.2	2.29	
Imlaystown	91	35	62.4	1.77	
Indian Mills	94	33	62.2	1.52	
Lakewood	90	36	60.0	2.20	
Lambertville	88	37	61.4	2.21	
Layton	92	29	57.9	1.11	
Moorestown	87	38	61.2	2.45	
Mount Pleasant				1.15	
Newark	91	37	59.6	1.58	
New Brunswick	89	36	61.4	1.70	
New Egypt				1.58	
Newton	90	33	58.4	3.18	
Oceanic	88	39	59.5	1.24	
Paterson	95	38	62.2	3.37	
Pemberton	88	35	60.8	1.46	
Plainfield	90	34	59.6	1.47	
Ringwood	92	31	57.8	3.24	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Rivervale	90	32	57.6	4.63	
Roseland	91	34	57.5	2.29	
Salem	92	39	63.2	1.99	
Somerville	93	32	61.0	1.84	
South Orange	88	36	59.0	1.91	
Sussex	89	34	59.4	4.33	
Three Bridges				2.33	
Tuckerton	87	34	59.4	1.22	
Vineland	93	37	62.5	1.35	
Woodbine	86	33	60.6	2.34	
Woodstown				1.56	
New Mexico.					
Alamagordo	100	45	71.9	T.	
Albert	92	42	67.5	3.76	
Albuquerque	89	33	64.7	0.23	
Alma	86	32	59.8	0.80	
Arabela	88	36	65.1	1.96	
Aztec	91[f]	29[f]	60.1[f]	0.77	
Bellranch				1.14	
Bluewater	100	27	59.2	0.70	4.0
Cambray				0.24	
Carlsbad	102	45	74.9	0.14	
Deming				0.20	
East View	82	32	59.2	1.69	6.0
Engle	92	41	66.2	T.	
Espanola	87	39	60.2	0.75	
Folsom	83	32	58.2	3.82	
Fort Bayard	86	36	61.8	0.31	
Fort Stanton	85[c]	34[c]	57.8[c]	1.88	
Fort Union	83	27	56.2	2.00	
Fort Wingate	92	26	56.2	1.56	10.5
Gage				0.00	
Galisteo	84[1]	35[1]	62.2[1]	2.14	T.
Gallinas Spring	97	38	66.6	1.62	
Horse Springs	83	27	56.4	1.85	6.5
Lordsburg				0.00	
Lower Penasco	92	43	70.4	0.35	
Mesilla Park	99	37	68.4	0.01	
Olio	97	32	63.8	0.31	T.
Raton	98	30	64.6	1.19	
Roswell	96	42	68.8	0.70	
Socorro	93	38	68.6	0.27	
Strauss				0.00	
Taos	84	29	57.3	1.90	
Winsors	74	24	47.8	3.71	1.0
Woodbury	85	26	61.4	0.88	T.
New York.					
Adams				6.16	0.8
Addison	91	28	57.6	2.26	T.
Adirondack Lodge	78	17	46.6	6.13	1.1
Akron				2.32	
Alden	84	28	55.3	3.74	T.
Angelica	88	23	54.3	3.97	T.
Appleton	89	26	54.0	1.64	
Athens				1.85	
Atlanta	89	24	54.0	2.97	T.
Auburn	88	26	56.2	4.65	T.
Avon	89	22	54.6	2.06	
Axton	84	18	48.6	5.10	T.
Baldwinsville [1]	87	27	56.4	3.98	
Bedford	89	34	56.9	3.65	
Blue Mountain Lake				5.85	
Botivar	87	24	54.8	3.14	
Bouckville	82	22	53.5	3.53	T.
Boyds Corners				3.44	
Brockport	87	28	55.8	1.34	
Caldwell	85	27	54.3	3.24	
Canaan Four Corners	85	24	53.0	2.99	T.
Canajoharie	85	23	54.2	2.27	T.
Canton	79	21	52.2	3.30	
Carmel	87	33	58.5	3.49	
Carvers Falls	90	25	52.5	3.37	
Cedarhill	90	28	57.0	2.69	
Cooperstown	82	24	52.5	2.76	T.
Cortland	85	25	55.8	2.79	
Cutchogue	80	36	57.0	0.84	
Dekalb Junction				3.48	T.
Elba	82	26	53.2	1.76	T.
Elmira	87	30	58.1	2.02	
Fayetteville	88	25	55.8	3.97	
Franklinville	85	25	54.0	3.97	T.
Gabriels	82	17	49.2	3.63	2.0
Gansevoort				3.04	
Glens Falls	89	27	57.3	2.12	
Gloversville	85	25	53.5	2.14	
Greenwich	85[d]	27[d]	55.0[d]	3.10	
Griffin Corners	82	22	52.6	2.11	T.
Harkness	88	23	53.8	3.31	T.
Haskinville				2.55	T.
Hemlock	85	28	55.6	2.28	
Honeymead Brook	88	30	56.2	3.03	
Humphrey	83	24	54.3	4.28	0.2
Indian Lake	82	17	49.4	4.06	T.
Ithaca	86	27	54.5	2.05	T.
Jamestown	88	26	53.4	3.32	
Keene Valley	88	21	51.4	3.49	T.
King Ferry				2.57	T.
Liberty	83	26	54.8	1.82	
Littlefalls, City Res	84	22	53.6	3.63	T.
Lockport	87	27	56.2	1.55	
Lowville	86	21	52.4	4.21	
Lyndonville				2.05	
Lyons	90[b]	26[c]	58.8[c]	3.03	
Meredith	79	19	51.4	3.41	T.
Middletown	88	33	58.4	2.92	
Mohonk Lake	84	30[b]	56.0[d]	2.78	
Moira	85	22	53.0	3.80	
Newark Valley				2.80	
New Lisbon	83	20	51.6	2.94	
North Hammond	89	24	53.6	2.94	
Nunda	90	25	55.8	2.29	T.
Ogdensburg	80	20	53.3	2.01	
Old Chatham				3.00	
Oneonta	86	25	54.7	2.82	T.
Oxford	85	24	55.0	2.73	T.
Palermo				1.33	
Penn Yan	90	27	55.9	1.54	T.
Perry City	88	21	53.6	2.14	T.
Plattsburg Barracks	77	20	53.1	4.10	
Port Jervis	91	33	59.0	2.59	
Primrose	92	37	59.0	3.52	
Redhook				2.02	T.
Richmondville	90	23	54.4	2.39	T.
Ridgeway	84	28	54.6	2.13	
Rome	84	24	55.0	4.43	
Romulus	88	25	55.0	3.24	
Salisbury Mills				3.10	
Saranac Lake	87	17	50.2	3.93	T.
Saratoga Springs	88	25	57.1	2.78	
Scottsville				1.93	
Setauket	86	39	58.0	0.98	
Shortsville	87	26	55.0	2.66	
Skaneateles				4.25	
Southampton	75	36	54.9	0.80	
South Canisteo	90	24	55.2	1.77	0.2
Southeast Reservoir				3.75	
South Kortright	83	22	52.9	2.48	T.
South Schroon	85	20	51.8	2.77	T.
Straits Corners	85	22	53.4	1.48	T.
Ticonderoga	87	27	55.5	2.94	T.
Volusia	82	29	54.8	3.56	
Walton	90	25	53.8	1.91	T.
Wappingers Falls	87	35	58.6	3.11	
Warwick				4.30	
Watertown	86	21	53.8	3.05	
Waverly	89	24	57.6	1.97	T.
Wedgwood	86	25	54.0	2.33	T.
Wells	88	22	53.6	3.12	
West Berne	87	23	54.7	3.18	T.
West Chazy	84	24	50.3		
Westfield *e*	79	29	54.6	5.42	
Windham	85	22	53.2	2.03	T.
Wolcott	88	27	54.9	3.73	T.
North Carolina.					
Biltmore	83	43	65.6	1.40	
Brevard	88	31	65.8	2.64	
Brewers	95	38	68.2	3.90	
Bryson City				2.48	
Chapelhill	93	42	71.2	2.23	
Cherryville	94	43	71.5	4.34	
Cranberry	76	42	63.6	3.29	
Currituck				1.51	
Durharm				2.14	
Edenton	89	48	69.4	2.11	
Fayetteville	94	46	71.5	1.84	
Flatrock	88	35	65.2	3.81	
Goldsboro	91	46	70.4	1.13	
Greensboro	93	43	70.0	2.51	
Henderson	92	44	69.8	2.86	
Hendersonville	89	38	66.7	2.14	
Henrietta	96	45	72.8	3.22	
Highlands	82	35	63.4	4.27	
Hot Springs	89	40	70.2		
Kinston	97	44	72.8	2.64	
Lenoir	93	41	69.4	2.33	
Linville	79[d]	32[d]	60.7[d]	4.18	
Littleton	91	41	67.2	4.39	
Louisburg	94	45	70.0	1.94	
Lumberton	91	50	72.6	3.42	
Marion	95	42	69.6	2.89	
Marshall	89[f]	38[f]	67.2[f]	1.68	
Mocksville	92	41	65.6	2.67	
Moncure	95	41	70.9	2.37	
Monroe	96	40	71.1	2.23	
Morganton	93	41	70.2	0.62	
Mountairy	91	43	68.4	2.27	
Murphy				1.89	
Newbern	89	47	70.6	3.26	
Oakridge	94	41	70.1	3.71	
Patterson [e1]	89	42	65.0	2.04	
Penelo	93	45	69.6	2.38	
Red Springs	93	44	72.2	1.85	
Reidsville	93	42	69.8	2.81	
Rockingham	93	47	71.8	4.33	
Roxboro	89	44	69.5	3.97	
Salem	94	41	71.1	1.67	
Saxon	93	38	68.6	1.94	
Selma	98	42	71.2	1.72	
Settle	94	44	70.9	1.92	
Sloan	93	43	70.6	1.03	
Soapstone Mount	92	37	68.6	3.80	
Southern Pines *a*	99	44	75.2	2.57	
Southern Pines *b*	94	46	72.6	1.98	
Southport	88	52	72.4	2.32	
Springhope [e1]	91	52	72.2	1.20	
Statesville	95	39	70.0	1.94	
Tarboro	96	45	71.6	4.83	
Washington	94	49	73.2	2.70	
Waynesville	86	36	64.4	2.81	
Weldon *a*	89	48	67.6	3.08	
Weldon *b*				3.07	
North Dakota.					
Amenia	85	30	56.8	3.19	T
Ashley	84	30	56.0	1.86	
Berlin	80	30	55.0	4.51	
Bottineau	91	25	50.6	4.10	1.0
Buxton	82	29	56.5	4.56	1.3
Churchs Ferry	87	29	54.6	3.87	0.6
Coalharbor	94	32	57.4	2.84	T.
Devils Lake	85	29	55.3	3.03	
Dickinson	95	30	56.8	3.02	
Donnybrook				2.58	
Dunseith	84	26	49.6	2.07	1.0
Edgeley	84	32	56.6	3.94	
Ellendale	86	32	59.2	4.07	
Falconer	84[c]	33[b]	58.4[c]	3.75	
Fargo	85	28	55.3	4.25	
Forman	86	31	57.0	4.04	
Fort Yates	85	34	58.7	3.12	
Fullerton	81	31	56.8	4.97	
Gallatin	80	29	52.9	3.52	
Glenullin	86	31	57.0	2.83	
Hamilton	90	25	55.0	3.85	4.0
Hannaford	84	28	55.3	3.36	T.
Jamestown	84	30	55.2	4.74	
Langdon	85	25	51.8	3.95	
Larimore	87	28	53.2	4.45	
Lisbon	84	30	55.8	3.48	
McKinney	89[c]	30[c]	54.6[c]	0.78	0.5
Mayville	90	30	57.0	4.57	
Medora	86	29	56.4	2.64	
Melville	83	30	57.0	4.32	T.
Milton	83	24	53.5	4.98	
Minnewaukon	86	29	57.0	3.76	0.1
Minot	94	31	60.8		0.5
Minto	87	27	55.0	3.68	
Napoleon	87	30	57.8	4.39	
New England	85[f]	25[b]	54.0[c]	2.68	0.4
Oakdale	88	31	56.4	2.30	
Pembina	91	25	54.2	4.75	2.2
Portal		28[c]	51.7[c]	2.83[c]	1.0[c]
Power	84	29	57.2	3.86	
Steele	86	31	58.9	2.54	
University	84	30	57.0	3.88	1.5
Wahpeton	90	31	59.7	3.60	
Willow City				2.04	T.
Woodbridge	86	26	53.3	4.96	3.0
Ohio.					
Akron	87	31	60.2	3.33	
Annapolis	91	29	61.0	2.69	
Atwater				3.72	
Bangorville	93	31	62.4	2.07	
Bellefontaine	88	36	62.0	2.04	
Bement				4.09	T.
Benton Ridge	92	35[c]	63.6[c]	3.04[c]	T.
Bethany	94	34	67.1	4.64	
Binola				3.79	0.5
Blaine				1.68	
Bloomingburg				1.35	
Bowling Green	91	32	59.8	3.81	
Bucyrus	92	32	62.4	2.04	
Cambridge	92	30	63.2	2.17	
Camp Dennison	93	37	67.2	4.25	
Canal Dover	93	33	61.1	2.03	
Canton	90	32	61.2	3.15	
Cardington	89	29	60.6	1.75	
Cedarville				1.61	
Chillicothe	95	35	62.8	2.36	
Circleville	91	36	65.6	1.27	
Clarksville	91	34	66.2	4.32	
Cleveland *a*	87	35	59.0	4.17	1.0
Cleveland *b*	89	33	58.2	3.21	
Clifton	89	35	64.4	1.59	
Coalton	92	34	65.9	3.10	
Colebrook	88	28	57.5	3.30	
Coolville				2.80	
Coshocton				1.40	
Dayton *a*				1.80	
Dayton *b*	92	36	65.4	2.39	
Defiance	93	32	60.8	3.51	
Delaware	93	31	63.0	2.56	
Demos	90	30	63.9	1.48	T.
Dunham				3.89	
Elyria	91	32	59.8	3.86	1.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Findlay	95	34	62.4	4.32	
Frankfort	91	32	65.2	2.62	
Fremont	93	36	61.4	4.16	
Galigher				3.26	
Garrettsville	88	28	58.2	3.94	0.3
Granville	92	33	63.2	1.43	
Gratiot	90	32	63.6	1.97	
Green	91	37	67.0	4.60	
Greenfield	88	38	66.2	2.57	
Greenhill	88	26	58.3	2.93	T.
Greenville	92	36	64.8	2.69	
Hanging Rock	92	36	67.3	3.42	
Hillhouse	88	24	55.9	6.18	
Hiram	86	30	59.3	3.59	T.
Hudson	92	27	59.1	2.76	
Jacksonboro	91	33	64.8	3.27	
Killbuck	91	29	62.0	3.10	
Lancaster	91	34	63.9	1.88	
Lima	93	31	62.9	0.87	T.
McConnellsville	90	34	64.4	2.25	
Manara	94	33	64.2	2.45	
Mansfield				2.50	
Marietta	88	37	66.6	4.60	
Marion	93	32	63.4	2.71	
Medina	94	31	60.8	3.02	T.
Milfordton	90	30	61.4	2.34	
Milligan	92	31	63.8	3.88	
Millport	89	31	61.4	3.12	
Montpelier	90	32	60.4	5.68	
Napoleon	91	36	62.0	3.58	
New Alexandria	93	30	64.8	2.75	
New Berlin	90	28	61.1	3.20	
New Bremen	93	31	64.1	2.74	
New Lexington				2.81	
New Paris	91	35	63.8	3.49	
New Richmond	90	38	67.8	6.93	
New Waterford	91	30	62.0	3.15	T.
North Lewisburg	94	32	64.0	2.35	
North Royalton	91	32	60.0	3.02	1.0
Norwalk	93	32	60.4	3.46	
Oberlin	91	31	60.0	3.39	
Ohio State University	89	31	63.2	0.91	
Orangeville	89	29	58.5	3.42	
Ottawa	91	33	61.8	3.01	T.
Pataskala	92	33	63.4	1.39	
Paulding	93	33	63.0	2.26	
Philo	93	33	65.6	1.99	
Plattsburg	98	32	64.7	1.87	
Pomeroy	94	38	66.6	2.46	
Portsmouth *a*				4.46	
Portsmouth *b*	93	40	69.0	4.34	
Pulse				3.04	
Red Lion				2.95	
Richfield				3.26	T.
Richwood	93	33	63.3	2.54	
Ripley	90	37	67.2	3.85	
Rittman	94	27	60.7	3.70	
Rock				2.34	
Rockyridge	93	36	60.0	8.92	
Shenandoah	92	30	59.7	1.41	T.
Sidney	94	35	65.2	3.40	
Somerset	95	34	66.3	2.67	
Springfield				2.87	
Strongsville				4.29	
Swanton				4.57	
Thurman	89	36	66.2	3.19	
Tiffin	88	36	60.8	5.06	
Upper Sandusky	95	32	62.1	1.09	
Urbana	88	35	62.2	2.25	T.
Vanwert	92	33	61.4	2.53	
Vickery	93	33	59.1	3.73	
Walnut				2.11	
Warren	90	29	58.6	3.19	T.
Warsaw	92	31	61.4	1.70	
Wauseon	93	31	60.2	6.45	
Waverly	93	37	67.0	5.08	
Waynesville	91	35	64.8	2.21	
Wellington	92	31	60.8	3.97	
Westerville	93	30	63.0		
Williamstown				2.01	
Willoughby				5.07	
Wooster	97	29	61.4	2.57	
Zanesville				1.86	
Oklahoma.					
Arapaho	93	56	76.0	17.11	
Beaver	98	43	69.6	8.69	
Blackburn	90	44	70.2	20.18	
Burnett	90	46	71.6	11.05	
Chandler	89	48	70.8	16.19	
Clifton	90	45	70.0	10.34	
Cloud Chief	91	46	69.7	11.49	
Enid	90	46	69.0	8.56	
Fort Reno	88	48	70.4	13.36	
Fort Sill	91	47	70.4	13.70	
Guthrie	87	48	70.2	11.69	
Hennessey	90	45	70.5	10.16	
Jefferson	92	42	71.4	8.23	
Jenkins	94	45	70.2[e]	13.62	
Oklahoma—Cont'd.	°	°	°	*Ins.*	*Ins.*
Kenton	92	40	66.0	4.88	
Kingfisher	89	48	70.3	14.57	
Mangum	98	52	73.4	9.75	
Newkirk	90	49	70.8	14.06	
Norman	87	48	70.2	12.40	
Pawhuska	91	45	72.4	11.37	
Perry	88	45	69.8	16.06	
Sac and Fox Agency	96	48	70.8	10.04	
Shawnee	93	49	71.4	10.08	
Stillwater	88	48	69.9	10.86	
Taloga	93	44	69.6	8.92	
Waukomis	98	46	70.9	7.75	
Weatherford	98	48	72.8	13.04	
Oregon.					
Albany *b*				3.51	
Alpha	86	37	53.9	5.59	
Arlington	90	37	59.8	1.27	
Ashland *b*	90	34	54.4	1.62	
Aurora *#1*	84	43	57.5	1.58	
Aurora (near)	87	35	55.8	2.98	
Bay City	68	34	51.4	7.81	
Bend	89	17	47.8	0.90	
Beulah				0.72	
Blackbutte	85	35	55.4	3.95	
Blalock	92	40	62.2	0.52	
Brownsville *#1*	82	46	55.9	3.23	
Bullrun				7.71	
Cascade Locks	88	42	57.2	4.11	
Comstock *#1*	86	42	54.6	2.12	
Coquille				4.13	
Corvallis	88	34	55.1	2.86	
Dayville	89	32	55.0	1.82	
Detroit	93	35	53.6	6.61	
Doraville	91	36	53.6	3.81	
Ella				1.42	
Eugene	85	38	55.0	3.99	
Fairview	80	39	54.0	5.17	
Falls City	86	35	53.1	3.81	
Forestgrove	91[d]	31[d]	55.8[d]	2.73	
Gardiner	72	36	49.8	5.68	
Glenora	90	35	53.0	7.84	
Government Camp	78	27	42.2	7.24	33.0
Grants Pass	96	30	56.4	1.30	
Hare	72	36	50.6	7.27	
Heppner	87	32	55.6	1.24	
Hood River (near)	91	33	56.4	1.06	
Huntington	92	29	61.0	0.59	
Jacksonville	91	34	54.7	1.33	
Joseph	83	25	48.2	1.37	1.0
Junction City *#1*	90	44	56.3	2.60	
Kerby	92	32	54.2	1.98	
Klamath Falls	94	24	52.8	0.50	T.
Lafayette *#1*	90	45	58.4	2.29	
Lagrande	86	31	52.0	2.45	
Lakeview	89	19	46.0	2.22	
McKenzie Bridge	92	29	53.6	6.13	
McMinnville	88	33	55.4	2.71	
Merlin *#1*	90	40	56.9	0.35	
Monmouth *a* *#1*	80	41	53.9	1.40	
Monroe	84	37	55.1	3.04	
Mount Angel	86	35	55.4	2.42	
Nehalem				7.05	
Newberg	98	34	55.0	2.24	
Newport	68	37	52.6	4.33	
Pendleton	93	34	59.7	1.78	
Pine	102	24	55.6	0.87	
Placer				3.20	
Prineville	90	24	57.2	0.94	
Riddles *#1*	94	42	56.6	2.07	
Salem	87	37	55.8	3.59	
Sheridan *#1*	87	38	56.4	2.34	
Silverlake	90	20	47.6	0.67	0.5
Silverton *#1*	80	46	58.1	3.30	
Siskiyou *#1*	94	31	53.2	1.54	1.0
Sparta	86	27	51.9	1.52	T.
Stafford	89	37	54.6	2.81	
The Dalles	92	36	61.2	0.63	
Toledo	79	37	53.7	4.86	
Umatilla	92	42	62.2	0.53	
Vale	91	25	55.5	0.39	
Wamic	87	31	54.1	0.51	
Warm Spring	94[f]	30[e]	55.7[e]	0.55	
Westfork *#1*	90	38	53.6	0.40	
Weston	83	29	53.3	4.01	
Williams	92	30	55.3	1.30	
Pennsylvania.					
Aleppo	89	28	63.2	1.90	
Altoona	88	32	60.8	1.30	
Athens	88	27	56.6	1.65	
Beaver Dam				1.73	
Bellefonte	88	33	62.6	2.30	
Brookville				3.68	
Browers Lock				2.03	
California	92	31	64.8	2.12	
Cassandra	86	28	58.1	1.61	T.
Clarion				3.54	
Coatesville	91	35	61.8	1.75	
Confluence				4.37	
Pennsylvania—Cont'd.	°	°	°	*Ins.*	*Ins.*
Davis Island Dam				2.78	
Derry Station	90	29	61.6	1.38	
Doylestown				1.83	
Drifton	76	30	55.4	1.20	
Driftwood				2.08	
Duncannon				0.58	
Dushore	88	25	54.8	1.16	
East Bloomsburg				0.93	
East Mauch Chunk	93	30	60.2	0.59	
Easton	89	37	61.2	2.22	
Ellwood Junction				3.05	
Emporium	89	30	58.8	2.29	
Ephrata	90	35	61.2	1.72	
Everett	88	33	60.2	1.16	
Forks of Neshaminy *#1*	87	44	60.2	2.02	
Franklin	89	26	58.4	3.76	
Freeport				3.38	
Girardville				1.31	
Grampian	88	27	57.2	2.81	
Greensboro				3.11	
Hamlinton	90	28	54.4	2.31	
Hawthorn	92	27	59.6	3.11	
Herrs Island Dam				2.25	
Huntingdon *a*	92	33	61.6	1.30	
Huntingdon *b*				0.91	
Irwin	92	33	66.0	1.83	
Johnstown	92	34	63.2	2.18	
Keating				1.86	
Kennett Square	90	36	61.6	1.42	
Lancaster	92[f]	37[e]	63.6[f]	0.89	
Lansdale				1.52	
Lawrenceville	91	26	56.7	2.16	
Lebanon	92	33	61.6	0.43	
Leroy	86	26	56.2	1.47	T.
Lewisburg	91	32	60.5	0.62	
Lockhaven *a*	92	32	63.4	0.70	
Lockhaven *b*				0.93	
Lock No. 4				2.05	
Lycippus	87	28	61.6	1.28	
Mifflin				1.45	
Oil City				3.65	
Ottsville				1.61	
Parker				2.87	
Philadelphia	90	41	63.4	1.74	
Pocono Lake	83	28	54.4	0.82	
Point Pleasant				1.72	
Pottsville				0.87	
Quakertown	91	33	60.4	1.55	
Reading *#2*			61.6	1.09	
Renovo *a*				1.43	
Renovo *b*	88	32	61.2	1.47	
Saegerstown	87	25	57.6	4.36	
Saltsburg				1.49	
Seisholtzville				2.08	
Selinsgrove	91	31	60.9	0.94	
Shawmont				1.73	
Smethport	86	26	55.3	3.30	T.
Smiths Corners				1.77	
Somerset	86	27	57.2	3.85	
South Bethlehem	90	37	61.0	1.07	
South Eaton	87	32	58.2	1.34	
Spring Mount				2.42	
State College	83	32	58.8	0.92	T.
St Marys	86	28	57.2	2.39	
Sunbury				0.10	
Towanda	87	29	57.6	1.06	T.
Troutrun				1.43	
Uniontown	87	40	64.3	3.10	
Warren	87	32	53.7	4.45	
Wellsboro	87	28	55.7	2.05	T.
Westchester	89	39	61.6	1.60	
West Newton				1.76	
Westtown	90	35	61.0	1.55	
Wilkesbarre	95	31	59.4	0.98	T.
Williamsport	93	34	60.2	1.45	
York	93	35	63.5	1.24	
Rhode Island.					
Bristol	69	38	55.6	1.14	
Kingston	77	31	54.3	1.34	
Pawtucket	87	39	59.0	1.08	
Providence *a*	91	36	60.4	1.20	
Providence *c*	89	34	57.1	1.31	
South Carolina.					
Aiken	106	58	79.5	2.02	
Allendale	95	57	76.6	2.26	
Anderson	96	46	74.8	2.74	
Barksdale	96	48	76.0	0.50	
Batesburg	97	51	74.1	0.90	
Beaufort	95	57	75.6	4.97	
Blackville	101	52	77.4	1.11	
Bowman	99	50	75.8	3.38	
Calhoun Falls				1.03	
Camden				4.62	
Cheraw *a*	93	47	71.8	4.04	
Cheraw *b*				4.08	
Clemson College	99	44	72.7	1.42	
Conway	94	48	72.0	2.50	
Darlington	96	48	73.6	3.78	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Duewest	94	52	74.8	0.82	
Edisto				3.76	
Effingham				3.44	
Florence	95	51	74.4	2.89	
Gaffney	97	46	74.6	1.34	
Georgetown	92	55	74.0	1.57	
Gillisonville	98	48	74.8	4.54	
Greenville	92	47	69.9	1.47	
Greenwood	93	50	74.0	2.12	
Heath Springs	97	42	72.4	2.56	
Kingstree *a*	90	52	71.7	2.77	
Kingstree *b*				2.80	
Liberty	97	42	74.0	0.29	
Little Mountain	96	52	74.2	2.89	
Longshore	98	50	74.0	1.32	
Lugoff	97	47	73.6	3.72	
Pinopolis *1	90	58	74.6	2.35	
St. Georges	94	54	74.8	2.41	
St. Matthews	92	54	73.8	3.18	
St. Stephens				2.43	
Saluda	97	48	75.4	0.64	
Santuck	97	44	72.0	2.45	
Seivern	99	43	74.3	0.59	
Smiths Mills				5.65	
Society Hill	91	51	73.4	4.20	
Spartanburg	97	45	73.4	1.81	
Statesburg	94	52	74.4	2.25	
Summerville	93	52	73.4	3.25	
Sumter	95	50	73.3	3.22	
Temperance	96	49	72.6	6.53	
Trenton	95	53	75.0	1.62	
Trial	94	49	73.0	5.66	
Winnsboro	97	50	73.6	2.20	
Winthrop College	92	48	73.0	2.81	
Yemassee	95	53	75.8	2.04	
Yorkville	99	50	75.9	1.80	
South Dakota.					
Aberdeen	86	32	59.4	3.88	
Academy	87	34	61.2	2.50	
Alexandria	87	33	60.3	3.36	
Armour	89	32	60.3	1.44	
Ashcroft	86	32	57.0	3.98	
Bad Nation	99	27	66.1	1.61	
Bowdle	84	32	57.6	2.08	
Brookings	85	32	58.2	2.66	
Canton	88	32	62.6	4.54	
Centerville				4.07	
Chamberlain	88	37	62.2	1.66	
Clark	87	32	57.8	2.85	
Desmet	83	34	59.0	4.16	
Doland	86	33	59.7	2.67	
Elkpoint	92	36	63.8	1.76	
Farmingdale				2.74	
Faulkton	83	33	58.8	1.45	
Flandreau	85	33	58.8	4.57	
Forestburg	89	32	61.2	2.61	
Fort Meade	85	35	58.2	3.35	
Fort Randall	90[e]	34[e]	63.2[e]	1.36	
Gannvalley	89	36	62.4	2.04	
Grand River School	85	35	59.8	3.03	
Greenwood	92	38	64.6	1.85	
Hotch City	88	34	61.3	1.19	
Howard	85	31	58.6	1.07	
Howell	87	34	59.0	1.29	
Ipswich	93	34	60.4	8.35	T.
Kimball	86	36	61.0	1.75	
Leola	90	26	56.2	3.13	T.
Leslie	93	38	63.0	1.95	
Marion	88[d]	35[e]	60.7[d]	3.21	
Mellette	83	34	59.2	2.66	
Menno	89	34	62.4	3.73	
Millbank	88	32	58.0	3.73	
Mitchell	88	36	61.4	1.62	
Oelrichs	92	30	58.0	2.60	
Pedro	91	30	61.2	6.79	
Pine Ridge	89	32	59.2	1.13	
Plankinton	89	35	61.1	1.99	
Ramsey	89	32	60.6	4.43	
Redfield	84	36	58.4	2.30	
Rochford	82	15	48.0	2.52	
Rosebud	92	37	62.4	1.87	
St. Lawrence	85	34	57.3	1.82	
Silver City				3.80	
Sioux Falls	86	35	61.8	5.57	
Sisseton Agency	83	31	57.2	4.76	
Spearfish	84	36	56.2	3.50	
Tyndall	90	32	63.2	1.54	
Vermilion	89	37	64.4	1.32	
Watertown	80	32	56.8		
Waubay	83	30	56.8	3.25	
Wentworth	87	34	59.8	4.71	
Wolsey				2.03	
Tennessee.					
Andersonville	93	41	70.4	2.72	
Arlington	98	47	73.8	4.64	
Ashwood	91	40	71.5	1.90	
Benton	93	38	71.8	2.07	
Bluff City				2.07	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Bolivar	93	45	73.7	1.90	
Bristol	90	37	68.3	1.68	
Brownsville	95	46	72.8	3.14	
Byrdstown	91	38	68.8	1.63	
Carthage	92	45	71.0	3.03	
Clarksville	90	46	72.0	7.09	
Clinton				2.43	
Covington	92	48	73.4	4.25	
Decatur	93	38	71.0	3.35	
Dickson	92	42	72.4	4.00	
Dyersburg	96	50	74.4	2.06	
Elizabethton	92	36	68.6	1.87	
Erasmus	89	34	66.3	3.87	
Florence	90	44	71.6	4.81	
Franklin	90	45	71.8	3.38	
Grace *1	96	40	73.9	2.40	
Greeneville	89	37	68.2	2.14	
Harriman	91	42	69.8	3.30	
Hohenwald	92	40	70.1	3.88	
Iron City	93	40	72.2	1.77	
Isabella	89	43	69.5	2.47	
Johnsonville	94			2.43	
Kenton *5	93	46	73.3	2.57	
Kingston				3.72	
Lafayette *5	93	40	70.6	1.21	
Leadvale				0.16	
Lewisburg	92	38	73.0	2.01	
Liberty	94	40	71.1	6.41	
Lynnville	91	46	72.0	2.25	
McKenzie	96	48	75.4	1.47	
McMinnville	93	38	70.9	3.44	
Maryville	93	41	71.6	2.27	
Milan	93	42	74.4	2.16	
Newport	89	44	70.2	2.90	
Nunnelly	93	39	71.2	2.57	
Oakhill	89	36	68.1	3.00	
Palmetto	93	45	73.4	1.95	
Pope	95	40	73.3	4.13	
Rogersville	91	40	69.0	3.00	
Rugby	92[b]	32[b]	68.2[b]	2.56	
Savannah	91	45	74.0	7.04	
Sewanee	89	43	69.8	2.62	
Silverlake	86	35	64.4	2.99	
Sinking Spring				2.32	
Springdale	92	37	68.4	3.86	
Tazewell				1.99	
Tellico Plains	92	39	70.9	3.18	
Tracy City	95	35	69.6	2.95	
Tullahoma	88	38	69.8	2.67	
Waynesboro	92	39	71.3	3.24	
Wildersville	87	48	73.2	4.59	
Yukon	93	47	74.2	2.05	
Texas.					
Albany	90	52	74.6	5.79	
Alvin				4.69	
Anna	97[e]	51[e]	74.5[e]	5.19	
Anson				2.80	
Arthur				7.39	
Austin *a*	96	60	80.2	3.30	
Austin *b* *5	94	58	76.0		
Ballinger	97	50	75.4	7.08	
Bastrop	99	60	79.8	2.15	
Beaumont	100	64	81.0	2.02	
Beeville	97	61	79.6	3.75	
Bigspring	99	49	76.0	4.55	
Blanco	94	54	75.4	3.61	
Boerne *1	92	53	75.5	5.94	
Booth				2.89	
Bowie	92	51	74.6	4.67	
Brazoria	88	64	76.6	3.51	
Brenham	92	63	77.4	2.03	
Brighton	87	64	78.4	3.46	
Brownwood	103	50	77.8	2.47	
Burnet	96	50	76.4	2.72	
Camp Eagle Pass	102	58	80.8	2.86	
Childress	98	54	73.9	8.56	
Coleman	89[e]	53[e]	73.4[e]	4.71	
College Station		68		3.80	
Colorado	102	41	76.4	3.09	
Columbia	90	64	78.0	6.60	
Comanche	96[e]	47[e]	74.0[e]	4.96	
Corsicana	97	57	77.0	2.74	
Cotulla	101	58	81.4	5.80	
Cuero	96	77	80.7	6.10	
Dallas	96	51	76.1	2.93	
Danevang	92	63	77.7	2.56	
Dublin	92	55	74.8	6.72	
Duval	100	60	77.6	2.89	
Earls Ranch				5.32	
Estelle	95	55	75.6	2.63	
Fort Brown	95	66	80.4	2.35	
Fort Clark	98	51	76.1	8.40	
Fort Davis	97	45	72.1	0.67	
Fort McIntosh	110	51	83.7	0.18	
Fort Ringgold	107	68	86.9	0.70	
Fredericksburg	92[f]	54[f]	76.5[f]	4.97	
Gainesville	92[e]	49[b]	73.2[d]	4.18	
Georgetown	95	59	77.6	2.42	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Grapevine	96	55	75.3	4.32	
Greenville	96	51	74.2	4.33	
Hale Center	91	48	70.6	2.00	
Hallettsville	92	64	78.7	3.54	
Haskell	99	47	76.6	3.29	
Hearne	95	59	79.1	3.72	
Henrietta	93	51	73.8	4.50	
Hondo				4.61	
Houston	95	65	79.2	3.77	
Huntsville	92	60	78.2	4.31	
Ira	100	47	74.8	4.35	
Jacksonville	89	59	75.2	3.14	
Jasper	92	64	77.4	3.76	
Junction				5.79	
Kaufman	99	52	78.3	2.65	
Kent				0.21	
Kerrville	92	47	74.8	4.05	
Kopperl				4.50	
Lampasas	96	52	76.1	2.99	
Lapara				2.30	
Laureles Ranch				2.02	
Llano *5	97	55	79.0	2.35	
Longview	97	56	76.8	2.03	
Luling	94	58	77.9	3.63	
Mann	96	52	76.0	3.17	
Menardville	94	43	72.9	5.80	
Mount Blanco	98	44	73.0	2.12	
Nacogdoches	90[e]	56	76.0	4.54	
New Braunfels	92	61	78.4	3.35	
Panter				4.28	
Paris *a*	96	52	74.3	4.28	
Pearsall	100	58	80.6	3.91	
Port Lavaca	91	64	78.8	4.00	
Rhineland	96	46	76.4	3.28	
Rockisland	90	62	76.3	3.63	
Rockport	86	65	75.4	6.32	
Runge	96	58	79.9	6.29	
Sanderson	96	58	77.6	1.98	
San Marcos	95	59	78.1	4.51	
San Saba	96	50	76.2	4.03	
Santa Gertrude Ranch				0.87	
Shaeffer Ranch	105	59	80.2	1.92	
Sherman	95	54	74.9	8.81	
Sugarland	91	62	77.8	4.25	
Sulphur Springs	93	54	74.4	3.89	
Temple *a*	97	58	77.0	5.67	
Temple *b*	99	57	76.8	5.58	
Trinity	93	60	77.6	5.45	
Tulia	96	38	68.8	7.47	
Tyler	95	55	77.2	0.61	
Victoria				3.23	
Waco	95	57	80.0	5.57	
Waxahachie	95	50	75.4	6.60	
Weatherford	94	52	76.0	2.77	
Weimar	99	64	79.6	3.07	
Wharton	92	64	79.2	4.62	
Wichita Falls				11.05	
Utah.					
Alpine				0.60	T.
Aneth	91	34	64.0	0.37	
Bluecreek *1	90	40	64.1	0.89	
Castledale	86	20	53.8	0.45	
Corinne	96	27	58.4	1.45	
Coyoto	82	21	51.1	0.26	
Deseret	89	22	56.4	0.32	
Emery	74	24	49.0	T.	T.
Escalante	85	30	57.5	0.23	
Farmington	90	29	57.0	2.11	3.0
Fillmore	94	28	59.8	0.90	
Fort Duchesne	89[e]	25	59.6[b]	0.30	T.
Frisco	88	25	57.4	T.	T.
Giles	90	29	61.2	0.25	
Government Creek	85	21	55.4	0.61	T.
Green River	99	33	67.4	0.10	
Grover	80	26	54.8	0.45	1.0
Heber	84	22	52.4	0.49	T.
Henefer	84	21	51.6	1.49	2.0
Hite	96	41	69.2	0.40	
Huntsville				2.44	0.5
Kelton *1	87	38	61.1	0.28	
Levan	83	28	54.8	0.16	T.
Loa	79	14	46.0	0.10	
Logan	84	31	55.5	2.19	
Lund	90	24	56.1	T.	T.
Manti	85	27	54.3	0.49	T.
Marysvale	84	23	53.0	0.29	1.5
Meadowville	80	24	49.2	1.50	2.0
Millville				1.97	
Minersville	89	27	58.5	0.07	
Moab	93	34	63.9	0.84	
Monticello	82	26	54.5	1.13	2.0
Mount Nebo	90[e]	30[e]	59.6[e]	0.29	T.
Mount Pleasant	86	25	56.1	0.27	
Ogden	86	31	58.8	1.60	
Park City	73	21	48.4	0.67	3.0
Parowan	86	25	56.0	0.18	1.0
Pinto	81	26	50.2	0.19	T.
Plateau	80	17	49.8	0.63	4.3

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Utah—Cont'd.	°	°	°	*Ins.*	*Ins.*
Promontory				0.28	
Provo	90	28	56.4	0.36	
Ranch	80	21	48.9	0.64	
Richfield	85	27	55.0	0.32	
St. George	97	34	64.2	0.23	
Scipio	88	22	56.3	0.84	4.0
Snowville	86	24	54.0	0.63	
Soldier Summit	82	15	47.0	0.02	0.2
Thistle	92	37	59.4	0.35	
Tooele	86	30	57.4	1.26	
Tropic	87	13	49.3	0.86	
Vernal	87	29	58.9	0.52	
Virgin	92	36	65.8	T.	
Wellington	90	21	56.3	0.02	
Woodruff	82	20	48.2		0.2
Vermont.					
Burlington	82	26	55.1	4.46	T.
Chelsea	81	19	50.6	3.84	
Cornwall	87	25	53.6	2.85	
Enosburg Falls	82	22	50.6	4.96	1.5
Hartland	85	23	53.2	5.22	
Jacksonville	82	20	51.5	2.29	
Manchester	81	25	53.8	3.58	
Norwich	89	23	52.6	3.32	T.
St. Johnsbury	83	24	52.0	5.14	T.
Vernon [e6]	88	33	56.3	1.80	
Wells	84	24	53.0	3.49	
Woodstock	87	26	52.4	3.59	
Virginia.					
Alexandria	89	42	66.3	2.23	
Ashland	91	43	67.8	4.00	
Barboursville	91	42	68.0	4.16	
Bedford	95	41	69.6	1.91	
Bigstone Gap	92	37	67.2	2.26	
Birdsnest [3]			62.2	1.75	
Blacksburg	90	33	64.9	1.85	
Bonair	89	43	66.8	4.55	
Buckingham	96	28	63.4	1.59	
Burkes Garden	83	29	60.8	2.61	
Callaville [e]	89	40	68.6	2.15	
Charlottesville	92	40	67.0	3.99	
Clarksville				3.40	
Columbia	95	38	68.4	1.70	
Dale Enterprise	94	33	63.5	3.28	
Danville				2.53	
Farmville	95	42	69.8	1.30	
Fredericksburg	93	42	66.9	3.45	
Freeling	85	34	62.7	2.52	
Grahams Forge	91	35	65.3	3.69	
Hampton	88	46	67.4	2.76	
Hot Springs	91	30	63.6	1.77	
Lexington	93	38	66.2	3.28	
Lincoln	98	37	68.0	1.44	
Manassas	90	40	64.2	1.35	
Marion	89	35	65.1	1.80	
Mendota				2.59	
Newport News	90	49	69.2	2.75	
Petersburg	92	43	67.6	3.86	
Quantico	91	39	66.4		
Radford				1.05	
Riverton				0.65	
Roanoke	92[e]	40[e]	66.5[e]	1.45	
Salem				2.25	
Shenandoah				2.05	
Speers Ferry				2.27	
Spottsville	92	40	67.4	2.89	
Stanardsville	93	30	64.4	2.55	
Staunton	91	37	66.5	4.54	
Warsaw	91	38	67.1	3.15	
Westpoint	86	40	68.2	4.70	
Williamsburg	86	41	65.4	3.54	
Woodstock	93	35	66.5	2.01	
Wytheville	90	36	66.2	3.01	
Washington.					
Aberdeen	82	40	53.6	4.35	
Anacortes				1.98	
Ashford				5.50	
Bremerton	86	39	56.2	1.46	
Bridgeport	87	40	59.8	0.70	
Brinnon	82	38	55.4	1.32	
Cedonia	79	32	52.0	2.92	
Centralia	91	37	56.0	1.90	
Cheney				2.53	
Clearwater	77	40	53.4	6.44	
Cle Elum	85	28	52.6	0.78	
Colfax	85	32	53.4	3.03	
Colville	88	31	54.8	2.60	
Conconully	82	34	54.4	1.87	
Connell				0.91	
Coupeville	74	39	53.6	2.20	
Crescent	84	31	52.8	2.14	
Dayton	86	32	53.7	2.81	
East Sound	74	33	52.8	1.57	
Ellensburg	84	29	54.4	0.66	
Ellensburg (near)	86	32	55.9	0.57	
Grandmound	84	41	55.6	2.67	
Granite Falls				6.11	
Hooper	91	37	58.0	1.63	
Ilwaco	78	39	55.6	4.72	
Lacenter	90	38	55.6	3.56	
Lakeside	87	43	59.1	0.69	
Lind	89	33	58.8	2.22	
Loomis	86	38	58.6	2.05	
Mayfield	87	35	53.6	4.77	
Mottinger Ranch	92	40	62.3	1.15	
Mount Pleasant	88	35	54.6	4.27	
Moxee Valley	87	28	56.4	1.07	
Olga	74	42	55.0	1.69	
Olympia	91	38[d]	56.0	2.43	
Pasco	96	41	64.2	0.91	
Pinehill	90	32	57.1	0.83	
Pomeroy	92	36	57.2	3.93	
Port Townsend	75	42	54.0	1.95	
Pullman	85	33	53.4	2.42	
Rattlesnake Mountains	80	35	53.8	1.43	
Renton				3.25	
Republic	91	30	53.6	3.67	
Ritzville				0.93	
Rosalia	84	34	53.0	2.92	
Sedro	79	36	55.8	3.84	
Silvana	79	36	54.2	2.10	
Snohomish	79	39	55.6	3.35	
Snoqualmie	90	38	55.0	6.07	
Southbend	85	40	54.8	5.10	
Sprague				2.10	
Stampede				5.90	6.0
Sunnyside	86	33	58.4	0.86	
Union	82	36	54.9	2.31	
Usk	91	32	54.8	2.31	
Vancouver	87	37	55.9	2.28	
Vashon	77	42	55.0	2.00	
Waterville	87	34	54.7	1.22	
Wenatchee (near)	84	33	56.2	0.83	
Whatcom	72	37	54.4	1.87	
Wilbur	86	26	52.4	2.13	
West Virginia.					
Addison	90	34	66.0	5.50	
Bayard	90	24	60.0	2.75	
Beckley	88[b]	30[d]	62.9[c]	1.63	
Beverly	88	28	62.4	5.64	
Bluefield	90	32	64.9	2.90	
Buckhannon	90	32	64.4	3.50	
Burlington	92	31	62.2	1.80	
Cairo	98	33	65.6	1.30	
Camden	85	40	66.0	3.21	
Charleston				4.26	
Creston				1.75	
Dayton	92	33	63.9	3.47	
Echo	96	36	68.6	3.37	
Elkhorn	91	34	66.4	3.59	
Fairmont				2.26	
Glenville	98	35	65.0	4.17	
Grafton	90	30	63.8	5.02	
Green Sulphur	90	28	63.2	2.64	
Harpers Ferry				1.50	
Hinton *a*				3.07	
Hinton *b*	92	36	67.1		
Huntington	92	40	68.2	5.58	
Leonard	89	33	63.6	2.70	
Lewisburg	87	32	63.2	2.38	
Logan	96	38	70.0	3.35	
Magnolia	94	29	63.8	2.25	
Martinsburg	93	38	64.6	1.56	
Morgantown	88	31	64.2	1.72	
Moscow	90	30	61.8	2.12	
Moundsville	88	31	64.6	2.13	
Nuttallburg	94	34	67.1	3.67	
Oceana	92	37	67.2	3.54	
Oldfields	93	37	64.7	2.28	
Philippi	89	31	68.5	2.09	
Pickens	88	30	63.0	6.09	
Point Pleasant				4.12	
Powellton	93	37	67.7	3.95	
Princeton	87	40	64.8	3.75	
Rippon	91	34	63.8	2.07	
Romney	93	33	64.4	2.62	
Rowlesburg				3.26	
Southside	91	42	68.5	3.57	
Terra Alta	85	25	59.8	2.10	
Uppertract	89	29	63.6	2.23	
Wellsburg	88	30	62.1	2.28	
Weston *a*				3.34	
Weston *b*	92	39[d]	69.6		
Wheeling *a*				2.05	
Williamson	95	40	68.0	2.85	
Wisconsin.					
Amherst				5.75	4.0
Antigo	87	26	54.8	1.70	T.
Appleton	80	30	55.9	5.20	2.8
Ashland				1.66	1.5
Barron	86	28	57.2	3.63	T.
Beloit	85	37	61.3	7.39	
Brodhead	89	35	62.4	7.45	
Butternut	92	27	54.6	1.44	3.0
Chilton	87	29	55.4	5.22	3.0
Darlington	86	34	58.7	6.98	
Delvan	89	35	61.3	7.29	
Dodgeville	87	34	59.6	6.74	
Easton	88	31	56.9	8.96	4.0
Eau Claire	89	31	60.4	5.27	
Florence	88	25	54.9	2.61	T.
Fond du Lac	87	32	59.9	6.06	5.0
Grand River Locks				10.31	6.0
Grantsburg	92	29	60.4	2.85	1.0
Harvey	88	32	59.2	5.35	T.
Hayward	90	26	56.8	1.28	2.0
Hillsboro	86	32	58.8	8.32	1.0
Knapp	98	31	63.0	3.80	
Koepenick	96	24	56.8	3.50	
Ladysmith	88	28	57.4	1.96	
Lancaster	87	31	61.2	6.49	
Madison	86	33	59.8	5.16	
Manitowoc	83	33	54.8	3.70	
Meadow Valley	85	30	58.5	9.45	
Medford	90	26	58.0	5.30	1.0
Menasha				5.50	3.0
Neillsville	90	28	59.6	6.52	3.0
New Holstein	86	30	57.2	5.10	0.4
New London	86	30	56.7	8.17	6.0
North Crandon	87	25	54.2	3.01	T.
Oconto	84	29	56.2	2.79	
Osceola	87	32	57.6	2.54	T.
Oshkosh	86	30	57.6	6.35	2.0
Pepin	88	30	60.6	8.40	
Pine River	86	28	58.2	10.92	4.0
Portage	89	32	61.5	6.76	4.0
Port Washington	85	27	53.1	7.95	4.0
Prairie du Chien *a*	89	34	63.1	11.84	
Prairie du Chien *b*				12.20	
Prentice	87	29	56.1	2.45	4.4
Racine	86	35	57.5	5.77	
Sheboygan	84	32	57.0	5.43	4.0
Spooner	86[e]	27[e]	58.2[e]	1.65	2.0
Stevens Point	85	27	57.2	8.16	5.0
Valley Junction	91	21	60.5	10.64	1.0
Viroqua	88	30	59.0	11.60	1.0
Watertown	86	32	58.6	6.49	
Waukesha	84	31	57.6	5.96	2.0
Waupaca	86	30	56.8	6.89	4.0
Wausau	85	27	57.2	6.35	
Wausaukee	90	25	55.9	2.14	
Westfield	85	32	58.8	7.27	3.0
Whitehall	86	32	60.6	7.82	
Wyoming.					
Alcova	92	33	59.1	2.39	T.
Basin	89	29	61.4	0.61	
Bedford	83	17	48.2	2.33	
Border	81	20	48.1	0.78	
Buffalo	82	28	54.6	1.99	2.0
Centennial	76	21	46.6	0.16	
Chugwater	83	26	53.6	1.43	
Daniel	75	14	42.7	0.30	2.0
Diamondville	81	18	47.6	0.92	1.4
Evanston	76	18	46.6	1.25	2.8
Fort Laramie	90	29	57.4	3.61	
Fort Washakie	84	22	54.8	0.61	
Fort Yellowstone	77	23	48.4	1.59	2.4
Fourbear	74	16	48.4	0.75	4.0
Gillett	81	32	55.4	2.59	
Griggs	87	32	55.6	2.09	
Hyattville	93	24	57.4	1.95	
Irma	87	22	54.5	0.56	
Iron Mountain	82	22	53.2	1.22	
Lagrange [j]	90	34	59.0	1.20	
Laramie	75	20	49.0	0.26	1.5
Leo	77	23	48.8	0.92	1.2
Lusk	86	30	55.5	1.80	
Moore	83	27	53.5	0.90	
Parkman	81	24	54.4	2.40	
Pinebluff	85	30	56.6	2.22	
Rawlins	80	30	53.4	0.89	
Red Bank	84	28	55.0	2.80	
Rocksprings		25		0.52	
Saratoga	80	21	51.2	0.40	
South Pass City	70	11	42.4	0.40	4.0
Thayne	79	29	48.9	1.39	1.5
Thermopolis	91	26	59.2	1.93	
Porto Rico.					
Adjuntas	86	58	73.0	18.53	
Aguadilla	94	70	80.9	7.78	
Aguirre	93	68	79.0	3.96	
Arecibo	92	67	79.2	9.63	
Barros	88	56	74.4	30.70	
Bayamon	96	65	79.8	12.15	
Caguas	91	61	76.0	9.46	
Canovanas	93	70	80.0	12.70	
Cayey	95	63	76.9	11.33	
Cidra	87	60	75.2	11.43	
Coamo	93	63	77.0	12.12	
Corozal	91	62	76.4	20.47	
Fajardo	91	71	80.0	8.04	
Guayama				4.77	
Hacienda Amisted	91	54	76.4	7.91	
Hacienda Coloso	92	65	77.4	6.20	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Porto Rico—Cont'd.	°	°	°	*Ins.*	*Ins.*
Hacienda Perla	90	60	77.9	19.62	
Humacao	89	71	81.4	18.65	
Isabela	89	69	78.4	6.76	
Juana Diaz	90[1]	68[1]	79.0[1]	12.16	
La Isolina	87	64	75.2	25.56	
Las Marias	87	66	76.6	31.87	
Manati	93	64	78.8	5.89	
Maunabo	92	71	80.8	7.65	
Mayaguez	93	67	79.6	16.56	
Morovis	94	63	77.3	24.07	
Ponce[1]	89	63	77.6	7.09	
Rio Piedras	.....	.....	.....	9.20	
San German	94	69	82.0	15.62	
San Lorenzo	91	66	78.2	12.30	
San Salvador	87	62	74.3	17.86	
Santa Isabel	90	68	79.0	6.45	
Utuado	95	62	79.3	18.89	
Vieques	91	72	83.5	3.90	
Yauco	88	67	77.9	10.59	
Mexico.					
Ciudad P. Diaz	98	54	81.2	2.62	
Coatzacoalcos	98	70	81.6	2.50	
Leon de Aldamas	94	50	72.5	1.16	
Vera Cruz	89	70	81.4	0.90	
New Brunswick.					
St. John	66	33	47.8	4.70	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Late reports for April, 1902.					
California.	°	°	°	*Ins.*	*Ins.*
Kent	78[c]	36[c]	54.5[c]	4.62	
Kernville	.....	.....	.....	0.74	
West Point	.....	.....	.....	3.88	
Colorado.					
Fort Collins	80	18	45.7	0.61	.....
Indian Territory.					
Roff	92[f]	32[f]	61.0[f]	3.15	
Michigan.					
Pontiac	84	23	44.9	.....	
South Carolina.					
Blackville	91	34	62.7	3.21	
Tennessee.					
Arlington	86	34	58.0	2.20	
Brownsville	86	30	55.4	2.23	
Covington	84	35	59.0	1.45	
Jonesboro*[1]	80	38	55.2	2.55	T.
Milan	88	33	59.8	3.59	
Washington.					
Vashon	67	33	48.0	2.41	

EXPLANATION OF SIGNS.

*Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "*s*" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

April, 1902, under head of late reports for March, 1902, page 198, cut out all data for Blackville, S. C.

NOTE.—The following changes have been made in the names of stations: Abshers, N. C., changed to Brewers.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of May, 1902.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	22	24	8	22	s. 82 e.	14
Portland, Me	18	26	8	24	s. 63 w.	18
Northfield, Vt	34	21	9	11	n. 9 w.	13
Boston, Mass	13	18	11	32	s. 77 w.	22
Nantucket, Mass	14	31	9	23	s. 39 w.	22
Block Island, R. I	12	29	8	29	s. 51 w.	27
New Haven, Conn	21	23	7	25	s. 84 w.	18
Middle Atlantic States.						
Albany, N. Y	21	18	11	24	n. 77 w.	13
Binghamton, N. Y.†	10	3	12	14	n. 16 w.	7
New York, N. Y	17	22	15	23	s. 58 w.	9
Harrisburg, Pa.†	9	5	10	13	n. 37 w.	5
Philadelphia, Pa	18	21	15	23	s. 69 w.	8
Scranton, Pa	24	21	11	19	n. 69 w.	8
Atlantic City, N. J	14	28	14	22	s. 30 w.	16
Baltimore, Md	16	22	19	21	s. 18 w.	6
Washington, D. C	16	24	18	14	s. 27 e.	9
Lynchburg, Va	14	25	22	19	s. 15 e.	11
Norfolk, Va	13	31	23	8	s. 40 e.	23
South Atlantic States.						
Richmond, Va	16	27	17	17	s.	11
Charlotte, N. C	12	27	19	17	s. 8 e.	15
Hatteras, N. C	17	23	19	19	n.	6
Kitty Hawk, N. C.†	7	15	8	10	s. 14 w.	8
Raleigh, N. C	12	27	17	22	s. 18 w.	16
Wilmington, N. C	12	23	21	20	s. 5 e.	11
Charleston, S. C	10	28	21	16	s. 16 e.	19
Columbia, S. C	15	24	23	13	s. 48 e.	14
Augusta, Ga	16	27	20	11	s. 39 e.	14
Savannah, Ga	8	28	19	19	s.	20
Jacksonville, Fla	13	21	34	11	s. 71 e.	24
Florida Peninsula.						
Jupiter, Fla	4	25	38	10	s. 53 e.	35
Key West, Fla	20	6	45	3	n. 72 e.	44
Tampa, Fla	23	7	31	16	n. 43 e.	22
Eastern Gulf States.						
Atlanta, Ga	13	26	13	20	s. 28 w.	15
Macon, Ga.†	8	15	7	7	s.	7
Pensacola, Fla.†	9	12	11	6	s. 59 e.	6
Mobile, Ala	15	32	13	13	s.	17
Montgomery, Ala	15	26	21	15	s. 29 e.	12
Meridian, Miss†	7	15	11	8	s. 21 e.	8
Vicksburg, Miss	10	32	29	9	s. 42 e.	30
New Orleans, La	10	32	27	10	s. 39 e.	28
Western Gulf States.						
Shreveport, La	11	32	29	7	s. 46 e.	30
Fort Smith, Ark	9	20	40	4	s. 73 e.	38
Little Rock, Ark	12	34	19	12	s. 38 e.	28
Corpus Christi, Tex	5	37	40	0	s. 51 e.	51
Fort Worth, Tex	7	40	26	4	s. 34 e.	38
Galveston, Tex	1	41	34	6	s. 35 e.	49
Palestine, Tex	10	36	22	4	s. 35 e.	32
San Antonio, Tex	6	31	43	2	s. 59 e.	48
Taylor, Tex †	3	23	11	1	s. 27 e.	22
Ohio Valley and Tennessee.						
Chattanooga, Tenn	19	21	12	24	s. 81 w.	12
Knoxville, Tenn	23	23	11	21	w.	10
Memphis, Tenn	13	32	21	9	s. 32 e.	22
Nashville, Tenn	15	22	20	14	s. 41 e.	9
Lexington, Ky. †	6	14	8	10	s. 14 w.	8
Louisville, Ky	18	26	16	14	s. 14 e.	8
Evansville, Ind.†	5	15	12	6	s. 31 e.	12
Indianapolis, Ind	18	27	14	16	s. 13 w.	9
Cincinnati, Ohio	15	24	20	20	s.	9
Columbus, Ohio	12	17	21	23	s. 22 w.	5
Pittsburg, Pa	27	11	20	19	n. 3 e.	16
Parkersburg, W. Va	21	17	14	22	n. 63 w.	9
Elkins, W. Va	20	15	6	28	n. 77 w.	23
Lower Lake Region.						
Buffalo, N. Y	16	17	18	26	s. 83 w.	8
Oswego, N. Y	10	20	11	31	s. 63 w.	22
Rochester, N. Y	11	20	16	29	s. 55 w.	16
Erie, Pa	20	14	17	22	n. 40 w.	8
Cleveland, Ohio	21	20	20	18	n. 63 e.	2
Sandusky, Ohio	9	8	11	9	n. 63 e.	2
Toledo, Ohio	15	14	26	22	n. 76 e.	4
Detroit, Mich	19	16	23	21	n. 34 e.	4
Upper Lake Region.						
Alpena, Mich	14	21	26	16	s. 55 e.	12
Escanaba, Mich	23	19	19	12	n. 60 e.	8
Grand Haven, Mich	16	20	23	16	s. 60 e.	8
Houghton, Mich.†	5	6	17	8	s. 84 e.	9
Marquette, Mich	30	16	13	21	n. 30 w.	16
Port Huron, Mich	23	17	19	18	n. 9 e.	6
Sault Ste. Marie, Mich	12	17	24	22	s. 22 e.	5
Chicago, Ill	18	24	22	13	s. 56 e.	11
Milwaukee, Wis	24	13	25	17	n. 36 e.	14
Green Bay, Wis	19	23	25	14	s. 70 e.	12
Duluth, Minn	40	4	33	11	n. 31 e.	42
North Dakota.						
Moorhead, Minn	19	24	26	14	s. 67 e.	13
Bismarck, N. Dak	13	15	28	17	s. 80 e.	11
North Dakota.—Continued.						
Williston, N. Dak	20	23	19	10	s. 72 e.	10
Upper Mississippi Valley.						
St. Paul, Minn	15	29	22	12	s. 36 e.	17
La Crosse, Wis. †	6	16	9	7	s. 11 e.	10
Davenport, Iowa	11	20	27	16	s. 51 e.	14
Des Moines, Iowa	11	28	18	17	s. 3 w.	17
Dubuque, Iowa	15	20	28	15	s. 67 e.	13
Keokuk, Iowa	15	24	24	17	s. 38 e.	11
Cairo, Ill	16	32	18	9	s. 29 e.	18
Springfield, Ill	9	28	14	24	s. 28 w.	22
Hannibal, Mo. †	6	14	12	7	s. 32 e.	9
St. Louis, Mo	14	33	13	11	s. 6 e.	19
Missouri Valley.						
Columbia, Mo. *	6	15	12	3	s. 45 e.	13
Kansas City, Mo	14	32	23	6	s. 43 e.	25
Springfield, Mo	9	38	21	7	s. 26 e.	32
Lincoln, Nebr	14	30	24	7	s. 47 e.	23
Omaha, Nebr	12	30	25	12	s. 36 e.	22
Valentine, Nebr	14	26	17	15	s. 9 e.	12
Sioux City, Iowa †	6	15	11	8	s. 18 e.	10
Pierre, S. Dak	18	21	24	13	s. 73 e.	11
Huron, S. Dak	13	28	27	9	s. 50 e.	23
Yankton, S. Dak. †	5	14	12	6	s. 34 e.	11
Northern Slope.						
Havre, Mont	13	14	21	28	s. 82 w.	7
Miles City, Mont	17	19	18	22	s. 63 w.	4
Helena, Mont	10	27	7	39	s. 62 w.	36
Kalispell, Mont	10	22	18	28	s. 40 w.	16
Rapid City, S. Dak	16	19	20	23	s. 45 w.	4
Cheyenne, Wyo	15	26	8	27	s. 60 w.	22
Lander, Wyo	12	25	11	31	s. 57 w.	24
North Platte, Nebr	10	26	26	15	s. 34 e.	19
Middle Slope.						
Denver, Colo	13	26	18	19	s. 4 w.	13
Pueblo, Colo	17	17	22	22		
Concordia, Kans	12	32	22	5	s. 40 e.	26
Dodge, Kans	12	29	37	3	s. 63 e.	38
Wichita, Kans	10	41	17	6	s. 29 e.	33
Oklahoma, Okla	7	41	18	2	s. 25 e.	38
Southern Slope.						
Abilene, Texas	8	39	34	3	s. 45 e.	44
Amarillo, Tex	7	43	11	15	s. 6 w.	36
Southern Plateau.						
El Paso, Texas	15	10	15	37	n. 77 w.	23
Santa Fe, N. Mex	12	30	25	9	s. 42 e.	24
Flagstaff, Ariz	12	21	5	37	n. 74 w.	33
Phoenix, Ariz	8	9	27	28	s. 45 w.	1
Yuma, Ariz	8	26	8	31	s. 52 w.	29
Independence, Cal	24	16	9	27	n. 48 w.	36
Middle Plateau.						
Carson City, Nev	16	18	4	36	s. 87 w.	32
Winnemucca, Nev	19	18	9	33	s. 88 w.	24
Modena, Utah	7	20	5	40	s. 70 w.	37
Salt Lake City, Utah	25	18	23	12	n. 58 e.	13
Grand Junction, Colo	14	23	27	15	s. 53 e.	15
Northern Plateau.						
Baker City, Oreg	22	22	14	19	w.	5
Boise, Idaho	20	17	11	31	n. 81 w.	20
Lewiston, Idaho †	3	4	20	6	s. 86 e.	14
Pocatello, Idaho	3	37	16	20	s. 7 w.	34
Spokane, Wash	7	30	13	23	s. 23 w.	25
Walla Walla, Wash	7	42	6	12	s. 10 w.	36
North Pacific Coast Region.						
Neah Bay, Wash	6	23	13	35	s. 52 w.	28
Port Crescent, Wash. *	1	6	8	21	s. 69 w.	14
Seattle, Wash	16	33	9	10	s. 3 e.	17
Tacoma, Wash	19	26	3	28	s. 74 w.	26
Astoria, Oreg	9	26	7	40	s. 62 w.	37
Portland, Oreg	14	26	10	27	s. 55 e.	21
Roseburg, Oreg	18	14	10	33	n. 80 w.	23
Middle Pacific Coast Region.						
Eureka, Cal	27	17	9	20	n. 48 w.	15
Mount Tamalpais, Cal	27	8	1	43	n. 66 w.	46
Red Bluff, Cal	20	29	22	5	s. 62 e.	19
Sacramento, Cal	5	41	19	10	s. 14 e.	37
San Francisco, Cal	6	10	3	52	s. 85 w.	49
South Pacific Coast Region.						
Fresno, Cal	31	1	3	46	n. 55 w.	52
Los Angeles, Cal	11	19	13	32	s. 67 e.	21
San Diego, Cal	16	15	6	38	n. 88 w.	32
San Luis Obispo, Cal	18	5	2	37	n. 70 w.	37
West Indies.						
Basseterre, St. Kitts Island	22	9	41	2	n. 71 e.	41
Bridgetown, Barbados	1	25	52	0	s. 65 e.	58
Cienfuegos, Cuba	27	8	42	3	n. 64 e.	43
Grand Turk						
Havana, Cuba	14	1	55	1	n. 76 e.	56
Puerto Principe, Cuba	20	0	53	0	n. 69 e.	57
San Juan, Porto Rico	4	23	45	2	s. 66 e.	47
Santiago de Cuba, Cuba	51	5	8	5	n. 4 e.	46
Willemstad, Curaçao						

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Thunderstorms and auroras, May, 1902.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	52	T.	....	....	....	3	2	3	5	8	1	....	1	2	7	6	6	5	1	4	1	....	2	2	....	....	....	5	2	....	1	5	8	80	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arizona	56	T.	....	....	1	1	....	....	....	7	7	2	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	22	6	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arkansas	57	T.	....	....	....	6	....	6	1	....	....	....	....	4	7	9	11	....	1	11	9	2	3	5	2	....	3	17	....	3	4	8	10	122	20	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	1	A.
California	167	T.	....	....	1	....	....	....	....	....	....	....	....	....	2	1	....	....	....	....	....	....	....	....	1	7	13	1	....	....	....	....	7	33	8	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Colorado	81	T.	....	....	3	9	9	1	1	3	11	6	15	17	19	13	5	5	....	6	4	1	1	3	1	3	4	11	5	5	15	6	....	182	27	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Connecticut	21	T.	3	....	1	1	3	....	3	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	4	3	11	11	5	1	....	....	....	47	12	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Delaware	5	T.	....	....	2	....	....	....	2	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	8	5	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Dist. of Columbia	4	T.	....	1	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	....	1	1	....	....	1	1	1	1	....	....	....	....	....	9	9	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Florida	47	T.	4	8	6	4	2	1	1	1	6	4	1	1	5	6	9	6	3	4	6	7	7	3	....	....	1	11	6	4	7	17	16	157	29	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Georgia	55	T.	16	3	3	8	1	....	3	11	9	2	5	5	1	6	10	3	3	3	2	4	6	1	....	1	6	....	....	....	....	1	7	120	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Idaho	34	T.	2	1	....	....	....	....	2	3	1	2	1	....	1	4	1	....	3	1	....	1	....	....	2	....	....	....	3	....	....	....	4	32	16	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Illinois	92	T.	37	23	15	37	13	30	2	1	....	17	1	8	29	....	....	3	18	21	6	34	34	22	7	48	10	3	1	....	....	1	7	428	26	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Indiana	58	T.	2	2	1	12	6	11	1	1	2	7	3	3	12	1	....	1	....	2	21	24	9	17	23	26	10	....	....	....	....	1	1	199	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Indian Territory	11	T.	2	....	1	2	1	1	....	....	....	....	....	1	1	3	2	1	....	2	1	....	1	4	2	....	....	1	3	3	3	2	....	37	20	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Iowa	149	T.	23	26	28	24	7	6	1	2	3	11	....	3	24	5	2	2	5	24	12	19	27	29	21	20	19	4	2	....	....	....	21	370	27	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	1	A.
Kansas	77	T.	9	4	7	7	3	3	....	....	....	....	....	....	9	6	3	....	1	9	4	9	15	12	11	11	8	5	1	....	....	4	13	154	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Kentucky	41	T.	3	2	1	....	7	4	8	....	....	....	1	....	7	....	....	2	....	....	2	18	....	5	14	18	7	8	....	....	....	1	1	109	18	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Louisiana	46	T.	....	....	....	1	....	7	6	2	1	1	6	6	8	6	9	8	3	5	3	....	....	4	1	1	1	3	3	9	11	6	8	119	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Maine	19	T.	1	....	....	....	....	....	1	3	4	....	....	....	....	....	....	....	....	....	....	....	....	....	1	13	2	....	2	1	....	....	....	28	9	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Maryland	48	T.	....	21	3	....	14	6	6	....	....	1	1	2	9	....	....	....	....	17	12	....	2	9	10	29	5	....	....	....	....	....	....	147	16	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Massachusetts	48	T.	16	....	....	3	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	12	6	10	7	1	....	....	....	61	9	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Michigan	106	T.	....	23	21	31	3	24	1	1	....	....	1	....	2	....	....	....	2	19	26	15	3	16	27	20	15	2	....	....	1	....	2	255	21	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Minnesota	67	T.	18	16	17	3	1	2	3	....	6	3	2	10	....	....	2	6	22	12	22	18	10	1	14	20	....	1	....	....	....	....	....	209	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Mississippi	44	T.	....	....	....	1	....	3	2	2	1	....	....	2	11	4	7	12	10	9	13	....	....	11	3	....	1	10	1	4	7	7	7	128	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Missouri	95	T.	25	24	8	18	20	13	1	....	....	....	....	5	20	17	3	1	10	8	21	13	33	25	34	44	21	18	2	....	1	3	38	426	26	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Montana	40	T.	5	4	3	....	....	....	....	8	....	7	2	....	....	9	6	1	3	....	3	1	1	2	2	2	2	1	8	2	8	3	9	92	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Nebraska	142	T.	3	3	6	17	6	3	....	2	10	3	6	18	11	2	9	7	8	19	20	8	25	16	21	14	19	1	....	....	....	1	4	262	27	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Nevada	40	T.	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	1	....	....	1	....	....	1	2	5	....	2	....	....	....	14	7	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New Hampshire	19	T.	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	7	14	1	4	4	....	....	....	....	35	7	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	1	3	3	A.
New Jersey	51	T.	....	....	10	....	2	1	6	2	....	....	....	....	6	....	....	....	....	....	....	18	1	....	7	6	26	8	....	....	....	....	....	93	12	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New Mexico	31	T.	....	....	....	2	4	3	6	4	8	9	9	9	8	2	....	....	2	4	....	....	1	....	....	....	4	11	6	....	3	1	....	96	19	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New York	99	T.	4	2	1	18	8	17	6	2	3	1	....	....	....	....	....	....	....	....	4	10	....	12	40	36	29	14	2	....	....	....	....	210	18	T.
		A.	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	2	2	A.
North Carolina	56	T.	7	8	3	4	11	8	13	3	....	....	12	7	16	12	3	....	2	2	17	12	2	....	2	4	18	1	1	....	....	....	....	168	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
North Dakota	48	T.	9	....	....	....	....	....	1	....	....	2	3	1	....	....	....	....	9	4	4	3	1	....	1	1	....	....	....	....	....	5	6	50	14	T.
		A.	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	3	3	A.
Ohio	128	T.	....	36	5	23	15	19	....	....	....	1	....	....	19	....	....	....	....	2	32	30	8	50	36	50	37	8	1	....	....	....	....	372	17	T.
		A.	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
Oklahoma	23	T.	3	1	9	9	4	....	....	....	....	....	....	....	1	7	5	4	4	7	....	4	8	7	2	....	1	4	2	5	1	4	1	93	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Oregon	74	T.	....	....	....	....	....	4	2	6	3	6	....	1	6	2	1	....	....	1	....	....	....	....	....	....	....	3	5	....	4	....	....	44	13	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Pennsylvania	91	T.	1	20	4	9	4	11	2	....	....	....	....	....	1	....	....	....	....	1	12	12	....	7	7	7	34	21	....	....	....	....	....	153	16	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Rhode Island	7	T.	5	....	1	1	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	4	1	2	....	....	....	....	....	17	9	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Carolina	46	T.	11	5	8	5	1	....	8	8	5	6	7	3	7	18	6	1	4	6	8	2	3	....	....	....	14	3	1	....	....	1	12	153	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Dakota	56	T.	5	5	10	1	3	....	....	....	7	....	6	6	....	1	4	2	8	13	13	....	1	....	6	11	1	....	....	....	....	....	3	106	19	T.
		A.	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	A.
Tennessee	56	T.	11	....	2	2	11	2	8	....	....	....	....	4	15	11	3	2	2	3	3	9	3	1	3	6	7	2	....	....	....	3	5	118	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Texas	95	T.	....	....	2	15	18	6	2	1	....	....	6	4	5	10	6	2	4	29	2	....	4	2	....	....	1	1	3	4	9	13	10	159	24	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	1	A.
Utah	47	T.	....	....	....	....	....	....	....	2	1	8	11	4	....	1	....	....	2	1	2	4	1	....	1	....	1	7	2	3	1	....	1	53	18	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Vermont	16	T.	....	....	....	1	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	8	2	3	1	....	....	....	....	22	8	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	1	A.
Virginia	50	T.	....	12	5	2	11	19	17	1	1	....	3	1	17	4	....	....	2	1	10	....	1	3	15	19	17	4	....	....	1	....	....	166	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Washington	64	T.	....	....	....	....	....	....	2	5	3	8	....	3	1	....	3	1	2	....	....	....	....	....	....	....	....	....	5	....	3	....	....	36	11	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
West Virginia	43	T.	....	18	5	6	7	9	8	....	1	1	....	....	20	1	....	3	1	....	9	7	4	6	11	21	17	9	1	....	....	....	....	165	21	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Wisconsin	60	T.	10	18	18	10	....	3	2	1	1	6	....	7	3	2	....	1	11	12	13	6	17	4	21	17	6	1	....	....	....	....	2	192	24	T.
		A.	1	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	A.
Wyoming	31	T.	1	....	....	2	1	....	1	5	2	2	7	4	10	6	3	2	1	....	....	....	....	2	2	1	....	2	1	6	5	5	3	74	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Sums	2,893	T.	240	286	211	298	205	226	138	96	97	116	110	141	323	175	119	81	147	250	324	304	234	275	368	478	412	241	88	53	85	98	206	6,425	....	T.
		A.	1	2	0	0	0	0	0	1	3	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	0	0	3	1	2	17	....	A.

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during May, 1902, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y	27			0.74														0.14			
Alpena, Mich	23–24			0.59														0.54			
Atlanta, Ga	1	1:12 p. m.	3:20 p. m.	0.69	2:02 p. m.	2:25 p. m.	0.02	0.09	0.30	0.49	0.55	0.59	0.63								
Atlantic City, N. J	20			0.51														0.50			
Augusta, Ga	8	7:30 p. m.	11:30 p. m.	1.80	8:27 p. m.	9:20 p. m.	T.	0.14	0.34	0.54	0.74	0.99	1.20	1.34	1.39	1.50	1.56	1.61			
Baltimore, Md	25			0.51														0.51			
Binghamton, N. Y	25			0.87														0.43			
Bismarck, N. Dak	1			0.51														0.42			
Boise, Idaho	20			0.42														0.06			
Boston, Mass	19			0.42														0.13			
Buffalo, N. Y	6–7			0.57														0.30			
Cairo, Ill	1	D. N.	D. N.	0.81	3:10 a. m.	3:25 a. m.	0.16	0.10	0.33	0.63	0.64										
Charleston, S. C	25			0.38														0.35			
Charlotte, N. C	14	6:33 p. m.	9:00 p. m.	1.47	6:37 p. m.	7:20 p. m.	T.	0.26	0.45	0.65	0.86	0.93	1.01	1.07	1.17	1.16					
Do	25	3:04 p. m.	4:15 p. m.	1.13	3:10 p. m.	3:42 p. m.	0.01	0.18	0.43	0.61	0.88	1.05	1.11								
Chattanooga, Tenn	1			1.19														0.60			
Chicago, Ill	24	7:20 p. m.	11:30 p. m.	1.26	8:40 p. m.	9:20 p. m.	0.05	0.09	0.15	0.23	0.31	0.49	0.75	0.98	1.04	1.08					
Cincinnati, Ohio	20	12:02 p. m.	2:40 p. m.	2.37	12:07 p. m.	12:40 p. m.	T.	0.42	0.75	1.17	1.71	2.13	2.28	2.30							
Cleveland, Ohio	4–5	9:10 p. m.	10:10 a. m.	1.01	11:17 p. m.	11:35 p. m.	0.01	0.25	0.45	0.65	0.68										
Columbia, Mo	31	9:15 p. m.	11:45 p. m.	2.86	10:35 p. m.	11:35 p. m.	0.10	0.08	0.19	0.40	0.79	1.18	1.45	1.72	1.92	2.18	2.31	2.70			
Columbia, S. C	14			0.96														0.53			
Columbus, Ohio	24–25			0.37														0.21			
Corpus Christi, Tex	5	4:00 a. m.	7:30 a. m.	1.57	4:45 a. m.	5:40 a. m.	0.01	0.12	0.36	0.58	0.80	0.95	1.08	1.12	1.19	1.25	1.29	1.38	1.46		
Do	18	5:45 p. m.	6:50 p. m.	0.97	5:47 p. m.	6:15 p. m.	T.	0.15	0.17	0.37	0.70	0.83	0.93	0.95	0.97						
Davenport, Iowa	2	D. N.	D. N.	0.84	3:02 a. m.	3:32 a. m.	0.03	0.08	0.21	0.46	0.62	0.69	0.75								
Do	4	10:05 a. m.	4:05 p. m.	1.09	11:38 a. m.	12:15 p. m.	0.06	0.13	0.26	0.37	0.50	0.60	0.78	0.81							
Denver, Colo	27–28			1.05														0.14			
Des Moines, Iowa	22	8:03 p. m.	10:15 p. m.	0.67	8:20 p. m.	8:40 p. m.	0.01	0.13	0.41	0.47	0.53	0.56									
Detroit, Mich	23			0.35														0.34			
Dodge, Kans	21	9:55 a. m.	6:25 p. m.	1.10	10:40 a. m.	11:10 a. m.	0.05	0.20	0.47	0.57	0.63	0.68	0.72								
Duluth, Minn	19	3:20 p. m.	4:30 p. m.	0.50	3:23 p. m.	3:35 p. m.	0.01	0.22	0.37	0.42	0.45										
Eastport, Me	27–28			1.43														0.42			
Elkins, W. Va	24			0.63														0.54			
Erie, Pa	2			0.51														0.31			
Escanaba, Mich	4			0.97														0.42			
Evansville, Ind	24			0.55														0.40			
Fort Smith, Ark	21			0.33								0.33									
Fort Worth, Tex	13	4:03 p. m.	6:50 p. m.	1.12	4:20 p. m.	5:10 p. m.	0.06	0.06	0.18	0.28	0.44	0.52	0.62	0.67	0.77	0.86	0.95	1.00			
Galveston, Tex	8	2:20 a. m.	5:40 a. m.	1.00	2:25 a. m.	2:45 a. m.	0.02	0.22	0.52	0.65	0.84	0.86									
Grand Junction, Colo	11			0.22														0.08			
Green Bay, Wis	2			0.73														0.49			
Harrisburg, Pa	2			0.10														0.10			
Hatteras, N. C	11			0.69														0.66			
Huron, S. Dak	18			0.25														0.25			
Indianapolis, Ind	23	3:46 p. m.	4:18 p. m.	0.52	3:49 p. m.	4:00 p. m.	T.	0.25	0.46	0.50	0.51										
Jacksonville, Fla	19	5:00 p. m.	6:10 p. m.	1.26	5:00 p. m.	5:25 p. m.	0.00	0.16	0.58	0.93	1.18	1.23	1.26								
Jupiter, Fla	27	5:24 p. m.	6:45 p. m.	0.60	5:50 p. m.	6:05 p. m.	0.02	0.26	0.46	0.52	0.55										
Do	28	4:05 p. m.	5:55 p. m.	1.05	4:10 p. m.	4:45 p. m.	0.02	0.11	0.24	0.33	0.34	0.39	0.65	0.74							
Kalispell, Mont	14–15			0.54														0.23			
Kansas City, Mo	23	8:10 p. m.	10:15 p. m.	2.12	8:30 p. m.	9:30 p. m.	0.06	0.06	0.15	0.30	0.57	0.86	1.09	1.20	1.33	1.42	1.48	1.80			
Key West, Fla	14			0.12											0.12						
Knoxville, Tenn	24			0.50														0.50			
La Crosse, Wis	21	1:45 a. m.	10:00 a. m.	2.47	3:25 a. m.	3:45 a. m.	0.34	0.19	0.60	0.80	0.90	0.91									
Lewiston, Idaho	16–17			0.53														0.14			
Lexington, Ky	20			0.65														0.51			
Lincoln, Nebr	20			0.42														0.42			
Little Rock, Ark	15	4:00 p. m.	7:25 p. m.	1.27	4:20 p. m.	5:00 p. m.	T.	0.18	0.40	0.55	0.68	0.72	0.77	0.81	0.85						
Los Angeles, Cal	13–14			0.03														0.02			
Louisville, Ky	23	4:42 a. m.	10:30 p. m.	1.28	4:50 a. m.	5:50 a. m.	0.02	0.11	0.25	0.38	0.42	0.47	0.49	0.50	0.57	0.62	0.68	0.78			
Do	23	1:45 p. m.	6:25 p. m.	1.92	2:35 p. m.	3:45 p. m.	0.35	0.10	0.38	0.52	0.58	0.66	0.67	0.67	0.68	0.71	0.75	0.99	1.28		
Do	24	5:20 p. m.	6:50 p. m.	0.81	5:22 p. m.	5:43 p. m.	T.	0.07	0.21	0.35	0.60	0.61									
Macon, Ga	21			0.46								0.46									
Memphis, Tenn	26	4:00 a. m.	5:40 a. m.	1.10	4:10 a. m.	4:50 a. m.	0.02	0.16	0.47	0.55	0.56	0.57	0.65	0.89	0.99	1.01					
Meridian, Miss	19			0.88														0.64			
Milwaukee, Wis	23			0.70														0.47			
Montgomery, Ala	15	12:45 a. m.	7:50 a. m.	0.75	12:58 a. m.	1:33 a. m.	T.	0.05	0.15	0.19	0.42	0.48	0.55	0.61	0.62						
Do	15	2:18 p. m.	7:10 p. m.	1.73	2:26 p. m.	3:40 p. m.	T.	0.25	0.48	0.64	0.80	0.87	0.92	0.93	0.96	1.00	1.03	1.09	1.34		
Do	31	3:47 p. m.	5:02 p. m.	1.56	3:47 p. m.	4:34 p. m.	0.00	0.12	0.21	0.36	0.55	0.82	1.08	1.13	1.27	1.48	1.53	1.56			
Nantucket, Mass	25–26			0.19														0.11			
Nashville, Tenn	1			2.35														*			
New Haven, Conn	26			0.21														0.21			
New Orleans, La	13			0.42							0.41										
New York, N. Y	19			0.27								0.27									
Norfolk, Va	19	12:53 p. m.	2:15 p. m.	1.69	12:56 p. m.	1:37 p. m.	T.	0.19	0.63	1.00	1.15	1.15	1.16	1.22	1.46	1.66					
Northfield, Vt	23			0.42														0.42			
Oklahoma, Okla	18	12:55 p. m.	11:15 p. m.	1.56	1:10 p. m.	1:45 p. m.	T.	0.12	0.27	0.57	0.72	0.78	0.88	0.95							
Do	21–22	11:00 p. m.	D. N.	2.02	11:35 p. m.	12:20 a. m.	0.04	0.18	0.40	0.59	0.64	0.71	0.76	0.95	1.13	1.22					
Omaha, Nebr	25			0.79														0.25			
Palestine, Tex	18	5:15 p. m.	9:50 p. m.	0.91	5:17 p. m.	5:50 p. m.	T.	0.09	0.27	0.45	0.57	0.60	0.67	0.72	0.78						
Parkersburg, W. Va	24	3:28 p. m.	9:35 p. m.	1.55	4:35 p. m.	5:00 p. m.	0.24	0.07	0.29	0.59	0.83	0.97									
Philadelphia, Pa	25			0.40														0.35			
Pittsburg, Pa	2	5:15 p. m.	6:05 p. m.	0.59	5:35 p. m.	5:45 p. m.	T.	0.43	0.56	0.59											
Pocatello, Idaho	20–21			0.68														0.10			
Portland, Me	24			0.57									0.38								
Portland, Oreg	29			0.76														0.32			
Pueblo, Colo	27–28			2.29														0.38			
Raleigh, N. C	11–12			0.65														0.46			
Richmond, Va	24			0.28														0.28			
Rochester, N. Y	6			0.41														0.41			
St. Louis, Mo	4	1:50 p. m.	6:45 p. m.	1.77	3:10 p. m.	3:35 p. m.	0.46	0.13	0.47	0.87	1.10	1.17	1.18								
St. Paul, Minn	16			0.62														0.36			
Salt Lake City, Utah	20–21			0.14														0.08			
San Diego, Cal	14			0.05														0.05			
Sandusky, Ohio	4–5			1.05														0.59			
San Francisco, Cal	12–13			0.58														0.12			
Savannah, Ga	19	2:45 p. m.	5:30 p. m.	0.77	3:22 p. m.	3:37 p. m.	T.	0.15	0.32	0.51	0.55	0.56	0.57	0.58	0.60	0.64	0.72				
Scranton, Pa	23			0.37														0.30			
Seattle, Wash	17			0.43														0.12			
Spokane, Wash	8			0.13								0.13									
Springfield, Ill	20	3:30 p. m.	5:15 p. m.	0.93	3:57 p. m.	4:40 p. m.	T.	0.07	0.21	0.26	0.28	0.41	0.62	0.74	0.78	0.87	0.90				
Tampa, Fla	30	2:27 p. m.	7:10 p. m.	3.12	3:05 p. m.	4:25 p. m.	0.05	0.07	0.17	0.38	0.59	0.85	1.18	1.61	1.94	2.17	2.40	2.70	2.93	3.01	
Toledo, Ohio	24	2:00 a. m.	5:00 a. m.	1.14	2:52 a. m.	3:30 a. m.	0.08	0.25	0.32	0.39	0.43	0.48	0.63	0.74	0.81						

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
1	1	2	3	4	5	6	7														
Topeka, Kans.	21–22	.....	.....	1.09	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.48	.....	.....	.....
Valentine, Nebr	18–19	.....	.....	0.81	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.30	.....	.....	.....
Vicksburg, Miss	19	1:10 a. m.	5:15 a. m.	1.70	1:10 a. m.	2:00 a. m.	0.00	0.24	0.40	0.51	0.61	0.80	0.86	1.01	1.17	1.22	1.30	1.34	.....	.....	.....
Washington, D. C.	19	4:16 p. m.	5:10 p. m.	0.81	4:16 p. m.	4:40 p. m.	0.00	0.30	0.50	0.64	0.75	0.78	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	25	5:27 p. m.	6:45 p. m.	0.80	5:30 p. m.	5:50 p. m.	T.	0.22	0.60	0.74	0.79	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wilmington, N. C	11	.....	.....	0.69	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.62	.....	.....	.....
Yankton, S. Dak.	5	.....	.....	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.27	.....	.....	.....
Basseterre, St. Kitts	20–21	9:07 p. m.	D. N.	2.15	9:10 p. m.	9:40 p. m.	T.	0.10	0.35	0.60	0.71	0.76	0.83	.....	.....	.....	.....	.....	.....	.....	.....
					12:45 a. m.	1:20 a. m.	0.96	0.11	0.37	0.61	0.78	0.93	1.04	1.09	1.13	1.17	.....	.....	.....	.....	.....
Bridgetown, Barbados	25–26	.....	.....	1.61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.42	.....	.....	.....
Cienfuegos, Cuba	3	1:46 p. m.	3:25 p. m.	1.59	2:30 p. m.	3:05 p. m.	0.32	0.29	0.54	0.82	1.03	1.10	1.16	1.22	.....	.....	.....	.....	.....	.....	.....
Havana, Cuba	17	.....	.....	0.79	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.73	.....	.....	.....
Puerto Principe, Cuba	18	5:16 p. m.	6:10 p. m.	0.58	5:19 p. m.	5:31 p. m.	T.	0.27	0.35	0.37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Juan, Porto Rico	1–2	9:40 p. m.	2:55 a. m.	4.42	9:53 p. m.	10:48 p. m.	0.06	0.14	0.29	0.38	0.45	0.55	0.61	0.66	0.71	0.81	1.06	.....	.....	.....	.....
					11:45 p. m.	12:35 a. m.	1.22	0.11	0.19	0.28	0.33	0.53	0.67	0.70	0.72	0.81	0.84	.....	.....	.....	.....
					12:35 a. m.	2:35 a. m.	.....	0.96	1.02	1.09	1.29	1.37	1.57	1.65	1.67	1.68	1.69	1.79	2.27	2.72	2.93
Do	12	2:07 p. m.	2:50 p. m.	0.86	2:14 p. m.	2:32 p. m.	0.03	0.21	0.49	0.73	0.80	0.82	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	16	3:24 p. m.	5:04 p. m.	1.04	3:44 p. m.	4:23 p. m.	0.03	0.13	0.30	0.50	0.60	0.73	0.82	0.88	0.93	.....	.....	.....	.....	.....	.....
Do	17	3:00 p. m.	4:15 p. m.	1.05	3:28 p. m.	3:52 p. m.	0.06	0.21	0.43	0.66	0.88	0.97	1.00	.....	.....	.....	.....	.....	.....	.....	.....
Do	28	1:25 p. m.	2:45 p. m.	1.72	1:25 p. m.	2:00 p. m.	0.00	0.29	0.69	1.00	1.25	1.48	1.61	1.67	.....	.....	.....	.....	.....	.....	.....
Santiago de Cuba	12	4:47 p. m.	6:20 p. m.	0.82	4:48 p. m.	5:20 p. m.	T.	0.06	0.22	0.44	0.57	0.70	0.78	0.80	.....	.....	.....	.....	.....	.....	.....
Do	31	12:50 p. m.	2:18 p. m.	1.00	12:51 p. m.	1:16 p. m.	T.	0.33	0.49	0.70	0.82	0.89	0.92	.....	.....	.....	.....	.....	.....	.....	.....

*Self register not working.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, May, 1902.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure, in inches. Sea level, reduced to mean of 24 hours.	Pressure, in inches. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F.	29.81	29.95	−.03	43.7	+ 0.8	51.3	36.1	2.10	−1.56	0.4
Sydney, C. B. I.	29.93	29.97	.00	45.3	+ 0.1	53.3	37.3	2.67	−1.10	.....
Halifax, N. S.	29.85	29.96	−.02	48.8	+ 0.4	57.7	39.8	3.73	−0.53	.....
Grand Manan, N. B.	29.87	29.92	−.05	49.3	+ 1.4	55.8	42.8	4.35	+0.74	.....
Yarmouth, N. S.	29.89	29.96	−.02	47.2	− 0.4	54.2	40.1	3.21	−0.59	.....
Charlottetown, P. E. I.	29.89	29.93	−.03	47.8	+ 0.9	56.4	39.2	1.67	−1.24	T.
Chatham, N. B	29.85	29.87	−.08	48.2	− 0.3	58.7	37.6	4.96	+1.75	T.
Father Point, Que	29.85	29.87	−.06	43.4	− 0.6	52.0	34.8	4.06	+1.48	7.1
Quebec, Que	29.59	29.91	−.03	49.3	− 0.6	59.4	39.3	5.18	+2.10	.....
Montreal, Que	29.74	29.95	+.01	53.9	− 0.8	62.9	44.8	3.80	+0.85	.....
Bissett, Ont.	29.40	30.01	+.08	50.4	− 1.9	64.2	36.7	2.83	+0.32	.....
Ottawa, Ont	29.70	30.02	+.08	53.8	− 1.1	64.2	43.2	1.82	−0.77	.....
Kingston, Ont	29.67	29.98	+.02	51.7	− 1.2	60.1	43.3	1.96	−0.72	.....
Toronto, Ont.	29.64	30.02	+.04	53.4	+ 0.2	63.3	43.5	1.89	−1.15	.....
White River, Ont.	28.71	30.03	+.08	45.5	− 0.2	58.5	32.5	2.37	+0.42	0.4
Port Stanley, Ont.	29.39	30.03	+.06	52.9	− 0.2	62.8	43.9	3.47	+0.29	.....
Saugeen, Ont	29.32	30.03	+.07	51.3	+ 0.6	61.3	41.3	1.74	−0.70	.....
Parry Sound, Ont.	29.31	30.01	+.06	50.3	− 0.0	60.8	39.7	4.86	+1.93	.....
Port Arthur, Ont	29.30	30.01	+.05	46.7	+ 0.0	55.2	38.2	1.89	−0.26	.....
Winnipeg, Man.	29.10	29.92	−.04	55.1	+ 3.5	65.9	44.2	3.87	+1.59	.....
Minnedosa, Man.	28.12	29.92	−.04	53.2	+ 4.8	64.4	42.1	3.33	+1.88	1.2
Qu'Appelle, Assin	27.61	29.84	−.10	53.8	+ 4.0	64.6	43.1	6.95	+5.30	3.0
Medicine Hat, Assin.	27.54	29.80	−.09	56.0	+ 1.9	68.9	43.2	3.18	+1.87	.....
Swift Current, Assin.	27.28	29.83	−.09	54.8	+ 4.1	66.3	43.3	5.07	+3.31	T.
Calgary, Alberta	26.29	29.81	−.07	49.0	0.0	60.3	37.7	8.90	+7.13	27.6
Banff, Alberta	25.26	29.81	−.07	45.9	− 1.1	56.9	35.0	7.63	+5.59	27.0
Edmonton, Alberta	27.54	29.80	−.08	53.1	+ 2.3	64.6	41.6	7.67	+6.12	4.0
Prince Albert, Sask.	28.29	29.84	−.11	51.5	+ 3.9	63.3	39.7	4.87	+3.61	T.
Battleford, Sask	28.13	29.85	−.07	54.4	+ 3.4	66.2	42.6	3.08	+1.46	T.
Kamloops, B. C.	28.61	29.82	−.07	58.0	− 1.1	68.9	47.2	2.51	+1.27	.....
Victoria, B. C.	29.87	29.97	−.03	54.3	+ 1.8	60.5	48.0	0.97	−0.51	.....
Barkerville, B. C	25.58	29.87	+.03	44.8	− 0.7	55.9	33.7	4.34	+1.82	2.0
Hamilton, Bermuda	29.91	30.07	+.01	69.1	− 0.3	74.1	64.1	2.58	−2.08	.....

TABLE VII.—*Heights of rivers referred to zeros of gages, May, 1902.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,954	14	7.5	26,27	1.9	1,3	4.4	5.6
Reeds Landing, Minn	1,884	12	4.9	26-29	3.0	1	4.3	1.9
La Crosse, Wis	1,819	12	7.7	23	3.6	1	6.4	4.1
Prairie du Chien, Wis	1,759	18	10.8	24	2.5	1	8.0	8.3
Dubuque, Iowa	1,699	15	12.6	24	2.8	1	8.8	9.8
Leclaire, Iowa	1,699	10	8.0	26,27	1.2	1	5.4	6.8
Davenport, Iowa	1,593	15	10.4	26-28	2.2	1	6.8	8.2
Muscatine, Iowa	1,562	16	12.0	28,29	2.7	1	7.8	9.3
Galland, Iowa	1,472	8	6.0	31	1.0	2,3	3.6	5.0
Keokuk, Iowa	1,463	15	10.2	30,31	1.0	2	5.8	9.2
Hannibal, Mo	1,402	13	11.1	31	2.1	4-6	6.5	9.0
Grafton, Ill	1,306	23	12.3	31	5.2	7	8.3	7.1
St. Louis, Mo	1,264	30	18.2	30	7.6	9	11.7	10.6
Chester, Ill	1,189	30	14.7	30,31	6.0	10	8.9	8.7
New Madrid, Mo	1,003	34	19.0	31	12.7	26	15.3	6.3
Memphis, Tenn	843	33	14.6	9	8.5	28	11.1	6.1
Helena, Ark	767	42	21.3	10	13.7	30	17.2	7.6
Arkansas City, Ark	635	42	26.9	1	16.4	27	20.5	10.5
Greenville, Miss	595	42	22.7	1	12.9	27,28	16.5	9.8
Vicksburg, Miss	474	45	32.2	1	14.5	29	21.2	17.7
New Orleans, La	108	16	13.1	1	5.5	31	9.0	7.6
Missouri River.								
Bismarck, N. Dak	1,309	14	7.6	29	2.3	1	4.5	5.3
Pierre, S. Dak	1,114	14	7.6	25,31	3.9	8	5.3	3.7
Sioux City, Iowa	784	19	11.9	27,28	7.6	13	8.8	3.4
Omaha, Nebr	669	18	10.9	29	7.8	1,16,17	8.7	3.1
Plattsmouth, Nebr	641	17	7.1	29	3.7	1	5.2	3.4
St. Joseph, Mo	481	10	6.8	30	2.5	1,3,17	3.9	4.3
Kansas City, Mo	388	21	15.2	31	8.8	3	11.3	6.4
Boonville, Mo	199	20	12.2	28	7.7	7	9.1	4.5
Hermann, Mo	103	24	13.6	28	6.4	24	8.8	7.2
Osage River.								
Bagnell, Mo	70	28						
Illinois River.								
Peoria, Ill	135	14	11.9	30,31	9.2	1-6	9.9	2.7
Youghiogheny River.								
Confluence, Pa	59	10	3.9	21	0.8	18,19	1.7	3.1
West Newton, Pa	15	23	3.5	20	0.8	18,19	1.7	2.7
Allegheny River.								
Warren, Pa	177	14	2.8	6	1.2	4,23-25	1.8	1.6
Oil City, Pa	123	13	3.8	6	1.7	23,24	2.5	2.1
Parker, Pa	73	20	4.3	6	1.5	19,20	2.6	2.8
Monongahela River.								
Weston, W. Va	161	18	2.0	26	—0.2	10-13,18,19	0.1	2.2
Fairmont, W. Va	119	25	5.4	27	1.4	12-19	2.0	4.0
Greensboro, Pa	81	18	10.5	28	7.3	15-19	7.9	3.2
Lock No. 4, Pa	40	28	12.5	28	6.4	14,15	8.0	6.1
Conemaugh River.								
Johnstown, Pa	64	7	2.8	1,3,4	1.7	26,27,31	2.2	1.1
Red Bank Creek.								
Brookville, Pa	35	8	1.4	3	0.4	31	0.9	1.0
Beaver River.								
Elwood Junction, Pa	10	14	4.0	7,8,27	3.1	21,22	3.5	0.9
Great Kanawha, River.								
Charleston, W. Va	58	30	10.0	26	5.3	31	7.0	4.7
Little Kanawha River.								
Glenville, W. Va	103	20	4.6	26	—2.0	22-24	0.1	6.6
New River.								
Hinton, W. Va	95	14	2.8	27	2.0	13-15,31	2.3	0.8
Cheat River.								
Rowlesburg, W. Va	36	14	6.0	27	1.8	15	3.1	4.2
Ohio River.								
Pittsburg, Pa	966	22	8.1	29	3.3	12	5.6	4.8
Davis Island Dam, Pa	960	25	7.4	29	4.0	16,19	5.5	3.4
Wheeling, W. Va	875	36	8.6	30	4.8	17	6.4	3.8
Parkersburg, W. Va	785	36	9.0	1,31	5.8	21,22	7.6	3.2
Point Pleasant, W. Va	703	39	13.2	27	4.4	22	7.4	8.8
Huntington, W. Va	660	50	17.6	27	7.5	23	11.4	10.1
Catlettsburg, Ky	651	50	17.0	27	6.0	21,23	10.2	11.0
Portsmouth, Ohio	612	50	17.9	28	7.4	22,23	11.5	10.5
Cincinnati, Ohio	499	50	19.0	29	9.0	22	13.6	10.0
Madison, Ind	413	46	17.8	24	8.7	20	12.7	9.1
Louisville, Ky	367	28	8.9	24,25	5.4	20,21	7.0	3.5
Evansville, Ind	184	35	16.7	27	7.4	23	11.4	9.3
Paducah, Ky	47	40	16.5	6,7	6.8	24-26	11.0	9.7
Cairo, Ill	1,073	45	23.1	31	14.4	25	18.2	8.7
Muskingum River.								
Zanesville, Ohio	70	20	7.7	2	6.2	31	6.8	1.5
Scioto River.								
Columbus, Ohio	110	17	3.0	27-31	2.0	1-23	2.2	1.0
Miami River.								
Dayton, Ohio	77	18	1.4	26	0.6	20-22	0.9	0.8
Wabash River.								
Mount Carmel, Ill	50	15	10.1	29	1.8	21	4.1	8.3
Licking River.								
Falmouth, Ky	30	25	14.4	24	1.6	15-17	3.8	12.8
Kentucky River.								
Frankfort, Ky	65	31	8.2	25	6.1	18-21	6.7	2.1
Clinch River.								
Speers Ferry, Va	156	20	0.9	25	0.2	3,4,12,13	0.5	0.7
Clinton, Tenn	52	25	5.5	3	4.4	10,13	4.7	1.1
Holston River.								
Rogersville, Tenn	103	14	2.7	27	2.1	12-14,19,20	2.3	0.6
French Broad River.								
Leadvale, Tenn	70	15	1.8	26	0.0	1-6	0.6	1.8
Tennessee River.								
Knoxville, Tenn	635	29	3.3	27,28	2.0	13,14,19,31	2.6	1.3
Kingston, Tenn	556	25	5.6	2	2.3	27,31	3.1	3.3
Chattanooga, Tenn	452	33	9.3	3	4.0	28	5.2	5.3
Bridgeport, Ala	402	24	7.8	3,4	2.3	30	3.5	5.5
Tennessee River.—Cont'd.								
Florence, Ala	255	16	7.0	5	2.2	30	3.6	4.8
Riverton, Ala	225	25	9.1	5	2.4	30,31	4.2	6.7
Johnsonville, Tenn	95	24	9.6	7	3.6	31	5.6	6.0
Cumberland River.								
Burnside, Ky	516	50	5.7	4,8	2.6	24,25,31	3.7	3.1
Carthage, Tenn	305	40	19.5	3	2.2	30,31	5.4	17.3
Nashville, Tenn	189	40	24.8	2	3.3	31	9.1	21.5
Clarksville, Tenn[1]	126	42	32.8	2	4.4	30	12.8	28.4
Arkansas River.								
Wichita, Kans	832	10	5.5	23	1.4	1-13	2.1	4.1
Webbers Falls, Ind. T	465	23	18.1	25	3.3	6	8.2	14.8
Fort Smith, Ark	403	22	19.0	25	3.7	7	8.5	15.3
Dardanelle, Ark	256	21	17.8	26	3.2	6,9	7.6	14.6
Little Rock, Ark	176	23	18.1	28	4.8	8-10	8.5	13.3
White River.								
Newport, Ark	150	26	7.2	18	3.1	28	4.9	4.1
Yazoo River.								
Yazoo City, Miss	80	25	25.3	1	2.5	31	14.8	22.8
Red River.								
Arthur City, Tex	638	27	24.9	31	5.1	3	10.4	19.8
Fulton, Ark[1]	515	28	18.5	31	7.0	7,8	11.2	11.5
Shreveport, La	327	29	11.2	1	6.9	11	9.0	4.3
Alexandria, La	118	33	15.1	1	7.3	24	9.8	7.8
Ouachita River.								
Camden, Ark	304	39	8.9	1	5.2	30	6.8	3.7
Monroe, La	122	40	34.8	1	8.2	31	25.0	26.6
Atchafalaya River.								
Melville, La	100	31	31.6	1	19.2	31	25.1	12.4
Susquehanna River.								
Wilkesbarre, Pa	183	14	5.1	3,4	3.5	21-23	4.2	1.6
Harrisburg, Pa	69	17	2.8	1-3,6,7	1.7	24-30	2.2	1.1
West Branch Susquehanna.								
Williamsport, Pa	39	20	3.4	9	1.4	31	2.2	2.0
Juniata River.								
Huntingdon, Pa	90	24	4.0	1	3.2	25-31	3.5	0.8
Potomac River.								
Cumberland, Md	290	8	3.5	3	2.6	18,19	3.0	0.9
Harpers Ferry, W. Va	172	18	2.7	1,2	0.5	30,31	1.7	2.2
James River.								
Lynchburg, Va	260	18	1.5	3,4,8,9	0.9	17-20,23 / 24,31	1.1	0.6
Richmond, Va	111	12	1.3	10	0.3	4	0.6	1.0
Roanoke River.								
Weldon, N. C	129	30	12.5	1	9.2	31	10.5	3.3
Cape Fear River.								
Fayetteville, N. C	112	38	7.0	1,2	3.6	25,31	5.1	3.4
Edisto River.								
Edisto, S. C	75	6	4.2	1,2	2.9	14,15	3.3	1.3
Pedee River.								
Cheraw, S. C	149	27	4.4	12,16	3.0	7-9	3.7	1.4
Black River.								
Kingstree, S. C	52	12	5.0	1-4	3.0	16-19	4.2	2.0
Lynch Creek.								
Effingham, S. C	35	12	5.8	24	3.8	13,14	4.5	2.0
Santee River.								
St. Stephens, S. C	97	12	7.5	1	5.0	31	6.2	2.5
Congaree River.								
Columbia, S. C	37	15	2.0	21	0.8	29	1.5	1.2
Wateree River.								
Camden, S. C	45	24	11.7	15	6.7	31	8.0	5.0
Waccamaw River.								
Conway, S. C	40	7	2.8	11,12	1.4	25	2.2	1.4
Savannah River.								
Calhoun Falls, S. C	347	15	3.0	10	1.8	30,31	2.2	1.2
Augusta, Ga	268	32	11.3	11	8.0	31	9.4	3.3
Broad River.								
Carlton, Ga	30	11	3.7	6	2.6	30,31	3.1	1.1
Flint River.								
Albany, Ga	80	20	4.4	4,6	1.8	16,23	3.1	2.6
Chattahoochee River.								
Westpoint, Ga	239	20	4.7	3	2.9	31	3.7	1.8
Ocmulgee River.								
Macon, Ga	125	18	6.4	17	4.2	30,31	5.2	2.2
Oconee River.								
Dublin, Ga	79	30	5.5	4	1.1	31	2.8	4.4
Coosa River.								
Rome, Ga	271	30	3.7	3	1.8	28-31	2.5	1.9
Gadsden, Ga	144	18	3.0	1-6	1.2	30,31	2.2	1.8
Alabama River.								
Montgomery, Ala	265	35	7.4	18,19	2.7	31	4.9	4.7
Selma, Ala	212	35	9.5	19	3.8	31	6.7	5.7
Tombigbee River.								
Columbus, Miss	303	33	0.0	1	—2.5	30,31	—1.2	2.5
Demopolis, Ala	155	35	8.2	4	1.4	31	5.0	6.8
Black Warrior River.								
Tuscaloosa, Ala	90	43	10.8	1	1.6	31	4.6	9.2
Brazos River.								
Kopperl, Tex	369	21	5.0	20,24	—0.4	1-7	2.0	5.4
Waco, Tex	301	24	12.1	20	2.6	3,4	6.2	9.5
Booth, Tex	76	39	11.7	29	1.0	8,9	4.8	10.7
Red River of the North.								
Moorhead, Minn	418	26	10.5	23	8.0	2,5	9.1	2.5
Columbia River.								
Umatilla, Oreg	270	25	21.7	31	7.2	1-3	13.8	14.5
The Dalles, Oreg	166	40	36.3	31	10.7	1	21.7	25.6
Willamette River.								
Albany, Oreg	118	20	8.0	20,21	4.5	1	6.3	3.5
Portland, Oreg	12	15	19.7	31	6.1	2	12.6	13.6
Sacramento River.								
Red Bluff, Cal	265	23	4.4	1-5	3.6	27-31	4.0	0.8
Sacramento, Cal	64	29	21.8	15,18,19	20.8	31	21.3	1.0

[1] 30 days only.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San Jose de Costa Rica, during May, 1902.*

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1902.	Normal, 1889–1900.	Observed, 1902.	Normal, 1889–1900.	Observed, 1902.	Normal, 1889–1900.	Observed, 1902.	Normal, 1889–1900.	Duration, 1902.
	660+ *Mm.*	660+ *Mm.*	° *C.*	° *C.*	%	%	*Mm.*	*Mm.*	*Hrs.*
1 a. m	3.99	4.00	18.36	18.05	91	91	17.0	0.8	2.91
2 a. m	3.53	3.60	18.09	17.80	92	91	3.5	0.7	3.00
3 a. m	3.11	3.23	17.88	17.61	91	91	0.3	1.3	1.41
4 a. m	2.97	3.08	17.87	17.43	90	90	1.0	0.6	1.50
5 a. m	2.94	3.11	17.69	17.30	90	90	1.1	0.5	1.00
6 a. m	3.16	3.33	17.60	17.09	90	90	0.0	0.7	0.00
7 a. m	3.44	3.74	18.11	17.45	87	89	0.0	0.2	0.00
8 a. m	3.70	4.05	19.95	20.39	77	80	0.0	0.5	0.00
9 a. m	3.94	4.31	22.37	21.60	67	74	0.0	0.6	0.00
10 a. m	4.05	4.35	24.22	23.69	65	67	0.0	0.1	0.00
11 a. m	3.93	4.22	25.51	24.94	58	63	0.0	0.5	0.00
12 noon	3.58	3.97	26.81	25.63	54	64	0.0	1.4	0.00
1 p. m	3.11	3.44	26.86	25.80	59	62	0.0	4.6	0.00
2 p. m	2.68	2.95	25.36	25.30	61	65	21.4	18.5	2.09
3 p. m	2.33	2.62	24.25	23.85	69	71	41.8	21.5	5.59
4 p. m	2.16	2.44	22.82	22.60	74	76	48.9	40.4	4.34
5 p. m	2.25	2.58	21.65	21.32	80	80	11.9	36.4	3.91
6 p. m	2.58	2.90	20.90	20.57	84	85	27.2	34.2	6.25
7 p. m	3.02	3.36	20.25	19.71	86	87	43.1	26.6	7.66
8 p. m	3.45	3.81	19.67	19.24	88	89	33.8	20.1	8.25
9 p. m	3.79	4.17	19.30	18.99	89	90	20.9	11.7	5.33
10 p. m	4.07	4.40	19.11	18.67	89	90	10.3	5.5	3.33
11 p. m	4.18	4.51	18.84	18.30	90	91	15.9	3.4	4.09
Midnight	4.14	4.37	18.56	18.11	91	91	13.4	1.6	4.00
Mean	663.34	663.61	20.89	20.47	80	82	.....	.....	.....
Minimum	661.1	660.03	15.5	11.9	51	.....	.....	.....	.....
Maximum	665.5	666.62	30.8	32.5	100	.....	44.7	.....	.....
Total	.....	.....	.....	.....	.....	.....	335.1	232.3	64.66

REMARKS.—At San Jose the barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 1.5 meters above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. Since January 1, 1902, observations at San Jose have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San Jose local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San Jose local time; the barometer is 3.4 meters above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				
	Observed, 1902.	Normal, 1889–1900.	Observed, 1902.	Normal, 1889–1900.	0.15 m.	0.30 m.	0.60 m.	1.20 m.	3.00 m.
	Hours.	*Hours.*	%	%	° *C.*	° *C.*	° *C.*	° *C.*	° *C.*
7 a. m	13.55	12.61	66	58	22.60	22.31	22.45	21.58	21.03
8 a. m	22.20	19.43	.....	.....	.....	.....	.....	.....	.....
9 a. m	21.65	20.97	.....	.....	.....	.....	.....	.....	.....
10 a. m	22.85	21.52	61	64	22.38	22.35	22.48	21.63	.....
11 a. m	22.61	19.91	.....	.....	.....	.....	.....	.....	.....
12 m	21.13	16.85	.....	.....	.....	.....	.....	.....	.....
1 p. m	11.65	15.27	81	77	22.90	22.55	22.47	21.59	.....
2 p. m	14.33	14.21	.....	.....	.....	.....	.....	.....	.....
3 p. m	9.33	10.72	.....	.....	.....	.....	.....	.....	.....
4 p. m	4.34	7.01	90	89	23.18	22.72	22.45	21.54	.....
5 p. m	1.74	4.77	.....	.....	.....	.....	.....	.....	.....
6 p. m	0.50	2.01	.....	.....	.....	.....	.....	.....	.....
7 p. m	.....	.....	90	88	23.03	22.72	22.48	21.53	.....
8 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 p. m	.....	.....	86	77	22.78	22.65	22.47	21.53	.....
11 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
Midnight	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mean	.....	.....	78	76	22.71	22.57	22.47	21.56	21.03
Total	165.88	165.28	.....	.....	.....	.....	.....	.....	.....

TABLE 3.—*Rainfall at stations in Costa Rica, May, 1902.*

Stations.	Height above sea level.	Observed, 1902.		Normals.		
		Amount.	Number of days.	Number of years.	Amount.	Number of days.
	Meters.	*Mm.*			*Mm.*	
Sipurio (Talamanca)	60	*	*	1	102	13
Boca Banano	3	312	18	6	171	17
Port Limon	3	301	16	7	227	13
Swamp Mouth	3	314	18	4	134	11
Zent	20	323	19	1	23	7
Siquirres	60	522	18	4	153	16
Guapiles	300	445	28	1	159	7
Cariblanco (Sarapiqui)	835	696	29	4	358	17
San Carlos	161	400	22	3	261	17
Las Lomas	266	656	18	1	123	4
Peralta	332	361	21	4	368	20
Turrialba	620	181	20	7	210	19
Juan Viñas	1,040	245	19	6	134	8
Santiago	1,100	196	15	1	34	11
Paraiso	1,336	276	19	11 mo.	.....	.....
Cachi	1,020	164	17	6 mo.	.....	.....
Orosi	1,068	.....	.....	.....	.....	.....
Las Concavas	1,337	277	24	10 mo.	.....	.....
Cartago	1,450	*	*	6	185	14
Tres Rios	1,360	341	22	13	314	17
San Francisco Guadal	1,187	300	21	6	192	17
San Jose	1,160	335	22	13	207	18
La Verbena	1,140	303	22	6	170	14
Nuestro Amo	791	170	17	6	216	17
Alajuela	950	384	20	1	381	17
San Isidro Alajuela	1,346	606	23	1	311	24

* Not received.

TABLE 4.—*Observations taken at Port Limon and Zent, May, 1902.*

Stations.	Pressure.			Temperature.			Relative humidity.
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	
	Inches.	*Inches.*	*Inches.*	°	°	°	%
Port Limon	.....	.....	.....	22.3	31.1	26.30	83
Zent	.....	.....	.....	.....	.....	.....	.....

Stations.	Cloudiness.	Sunshine.	Rainfall.		Temperature of soil at depth of—		
			Amount.	Number of days.	0.15 *m.*	0.30 *m.*	0.60 *m.*
	%	*Hours.*	*Mm.*		°	°	°
Port Limon	73	.....	301	16	.....	.....	.....
Zent	.....	170.81	323	19	.....	.....	.....

MEXICAN CLIMATOLOGICAL DATA.

By Señor MANUEL E. PASTRANA, Director of the Central Meteorologic-Magnetic Observatory.

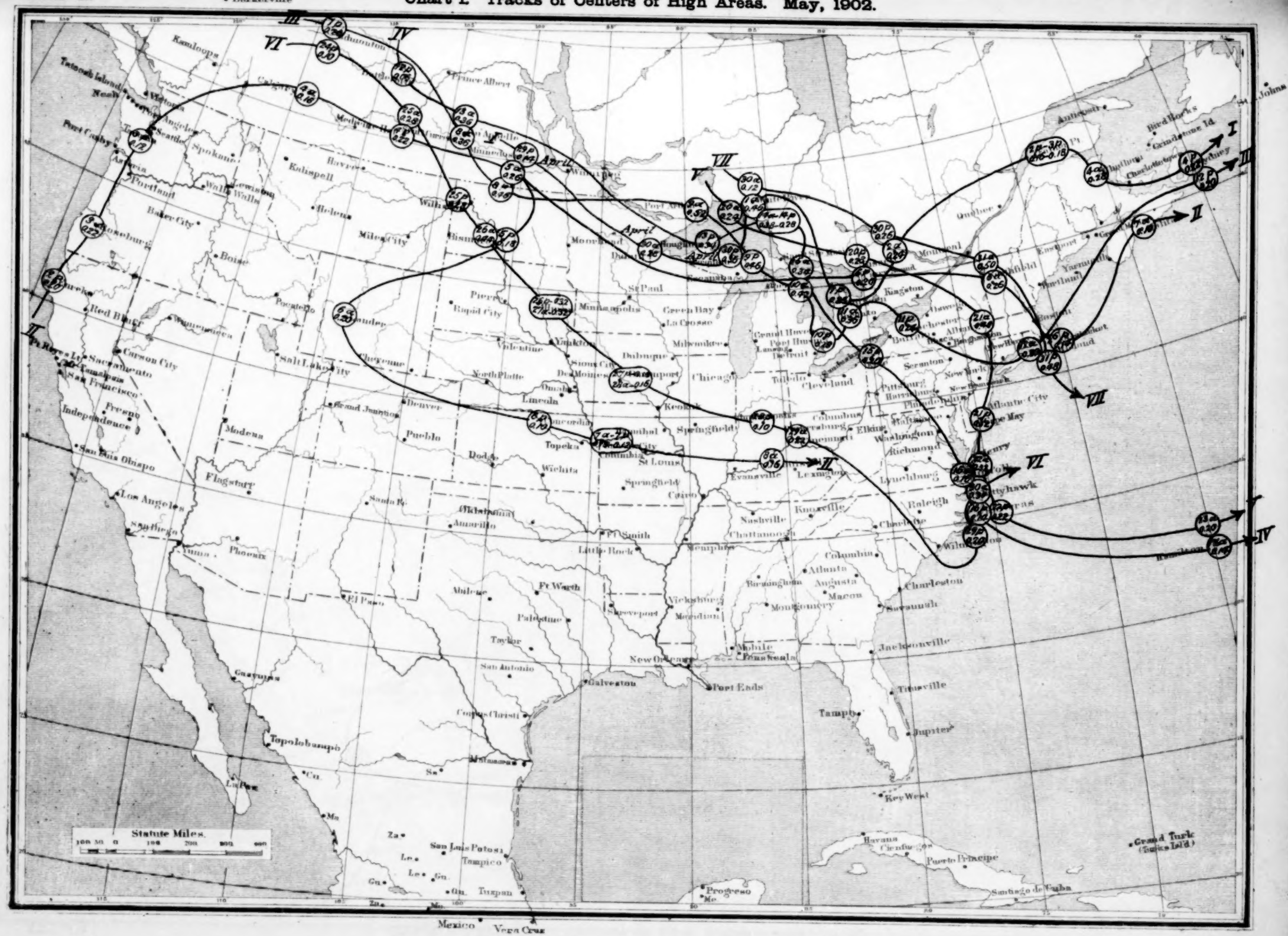
May, 1902.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Chihuahua	4,684	25.09	96.8	54.5	75.4	34	0.32	sw.	.....
Colima	1,600	.....	97.5	58.6	79.3	63	.....	s.	.....
Guadalajara (Obs. del. Est.)	5,186	24.87	94.5	52.5	76.1	41	0.58	nw., nnw	.....
Guanajuato	6,640	23.60	92.1	50.7	71.6	41	0.96	ene., sw.	.....
Leon (Guanajuato)	5,906	24.21	93.2	51.1	73.6	46	1.15	nw.	.....
Mazatlan	25	29.83	87.1	67.5	77.7	73	T.	nw.	.....
Mexico (Obs. Cent.)	7,472	22.98	87.1	48.2	65.3	47	0.65	ne.	sw.
Morelia (Seminario)	6,401	23.88	89.4	51.8	68.7	48	3.15	sw.	sw.
Puebla (Col. Cat.) *	7,108	23.32	84.7	51.3	67.5	61	2.43	ene.	.....
Puebla (Col. d Est.)	7,118	22.89	83.5	45.0	64.8	62	3.22	ene.	.....
Saltillo (Col. S. Juan)	5,399	24.67	96.8	53.2	72.3	56	0.47	nne.	.....
S. Isidro (Hac. de Gto.)	.....	.....	82.4	66.2	.....	.....	1.04	.....	.....
Toluca	8,812	21.91	82.6	36.3	60.3	48	1.42	.....	.....
Zapotlan	5,078	25.00	89.2	53.2	72.3	48	T.	se.	.....

Chart I. Tracks of Cen...
• Berkerville
XXX—42.

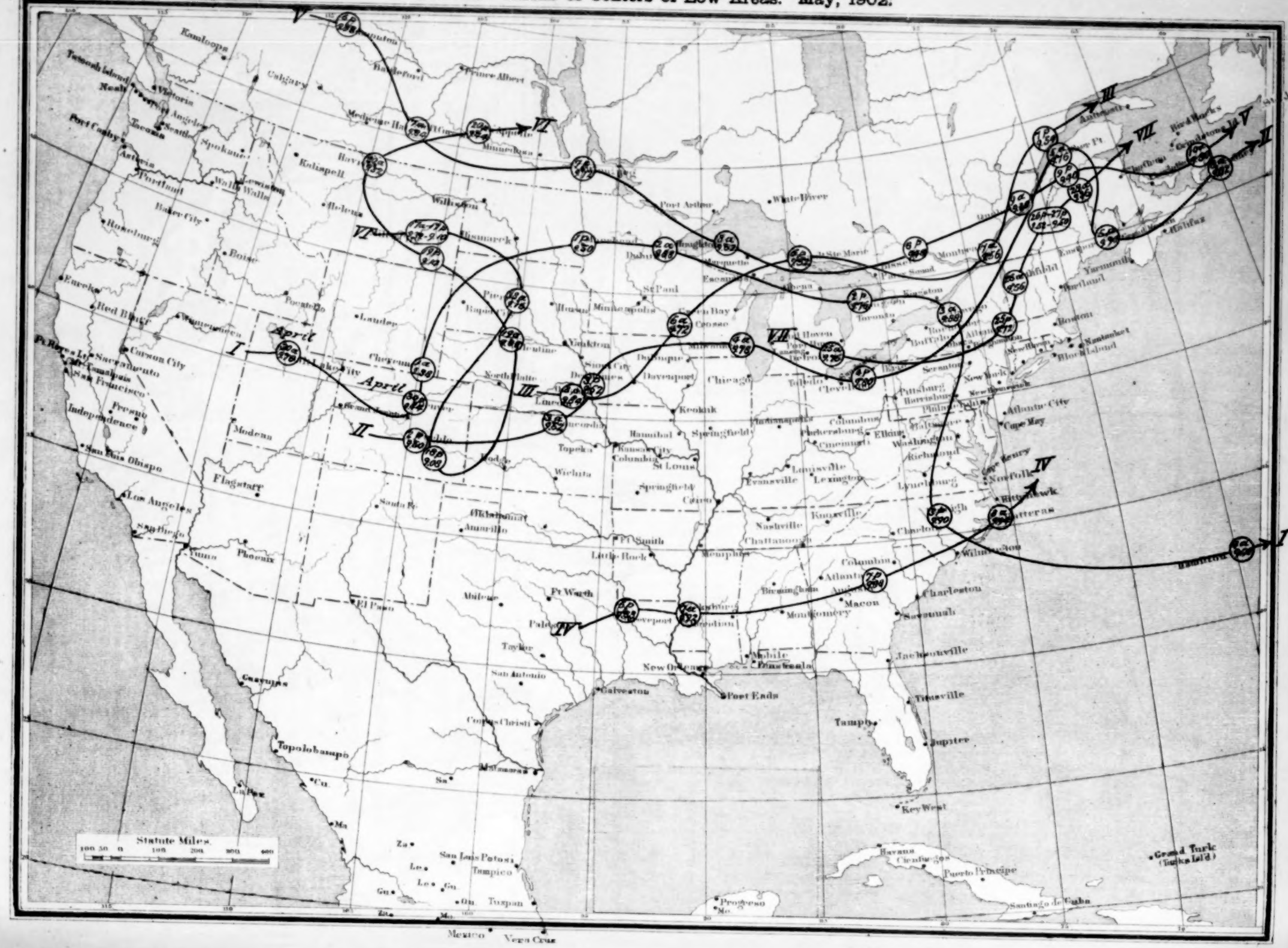
• Barkerville

Chart I. Tracks of Centers of High Areas. May, 1902.



• Baskerville

Chart II. Tracks of Centers of Low Areas. May, 1902.



• Baskerville

Chart III. Total Precipitation. May, 1902.

Chart III. Total Precipitation. May, 1902.

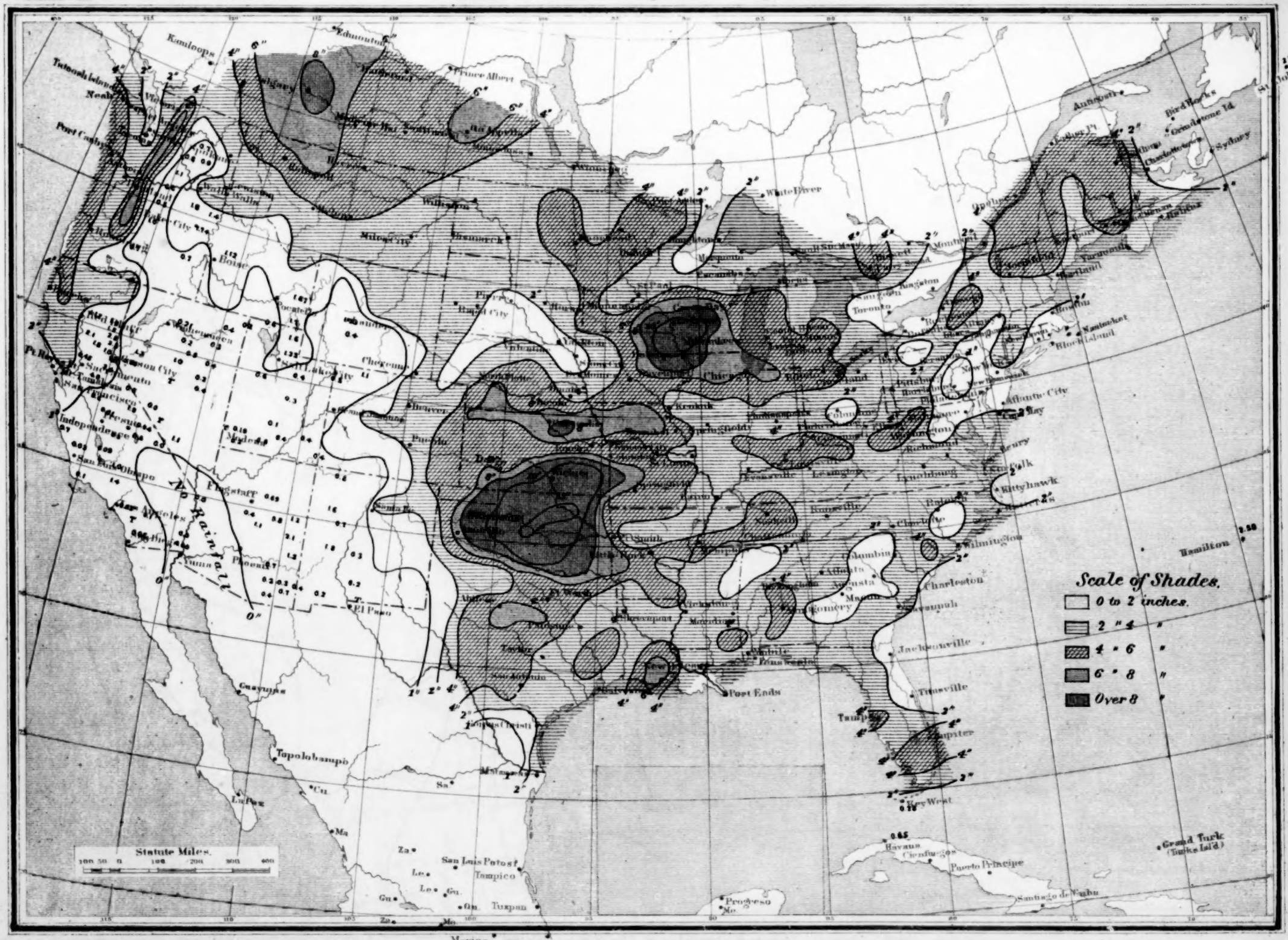


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Chart IV. Sea-Level Pressure; Resultant Surface Winds. May, 1902.

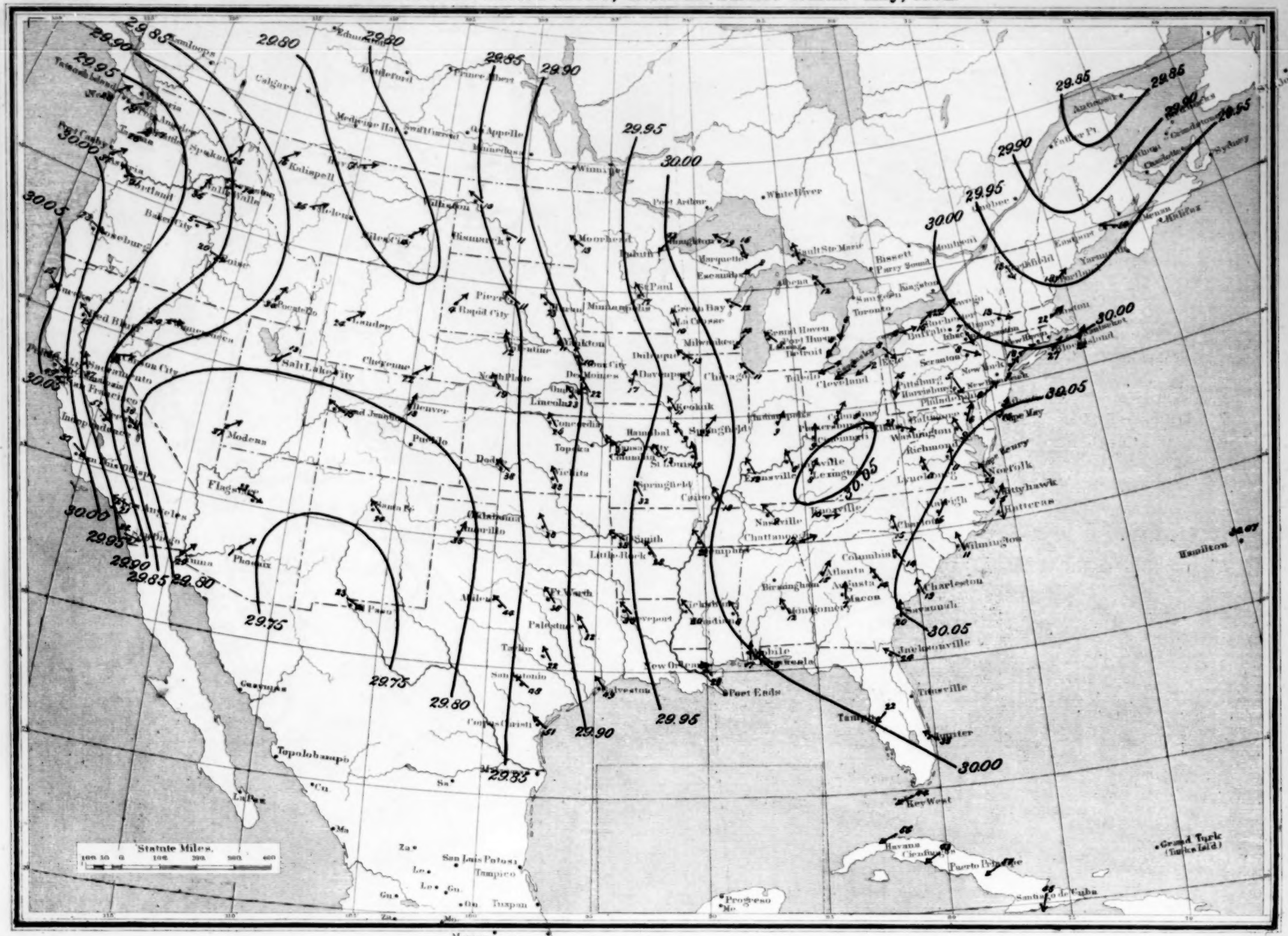
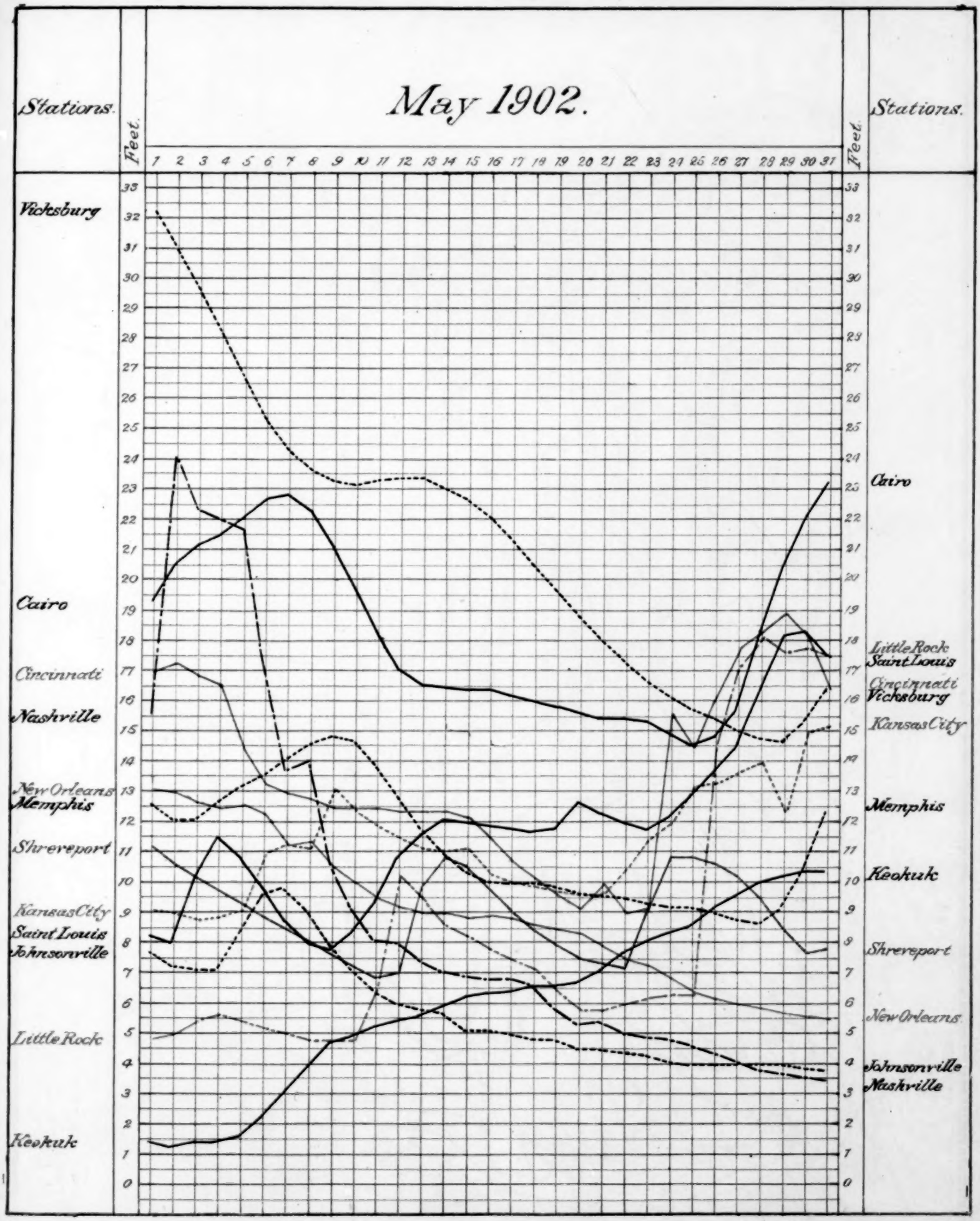
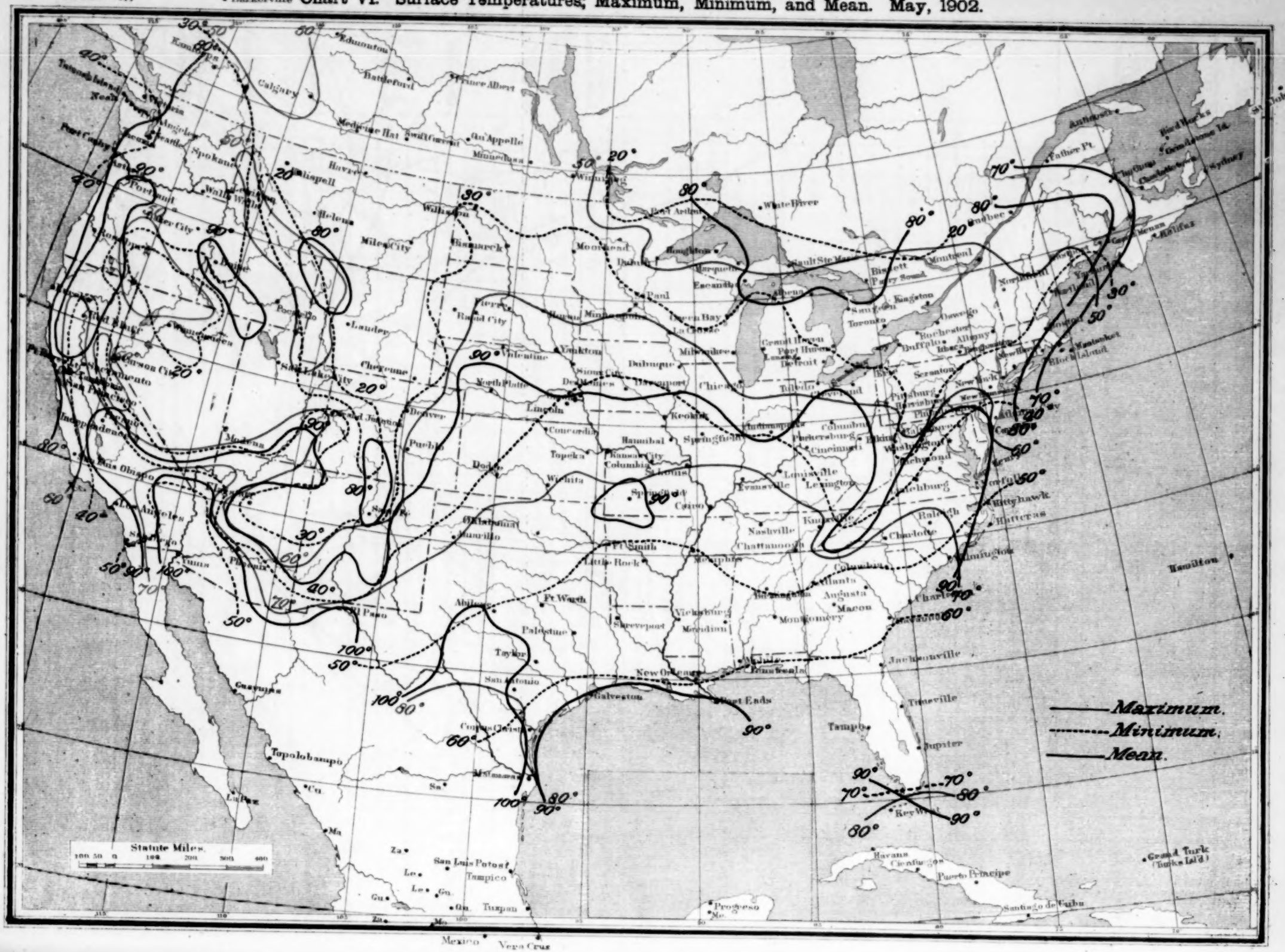


Chart V. Hydrographs for Seven Principal Rivers of the United States. May, 1902.



• Baskerville **Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. May, 1902.**



• Baskerville **Chart VII. Percentage of Sunshine. May, 1902.**

• Barkerville

Chart VII. Percentage of Sunshine. May, 1902.

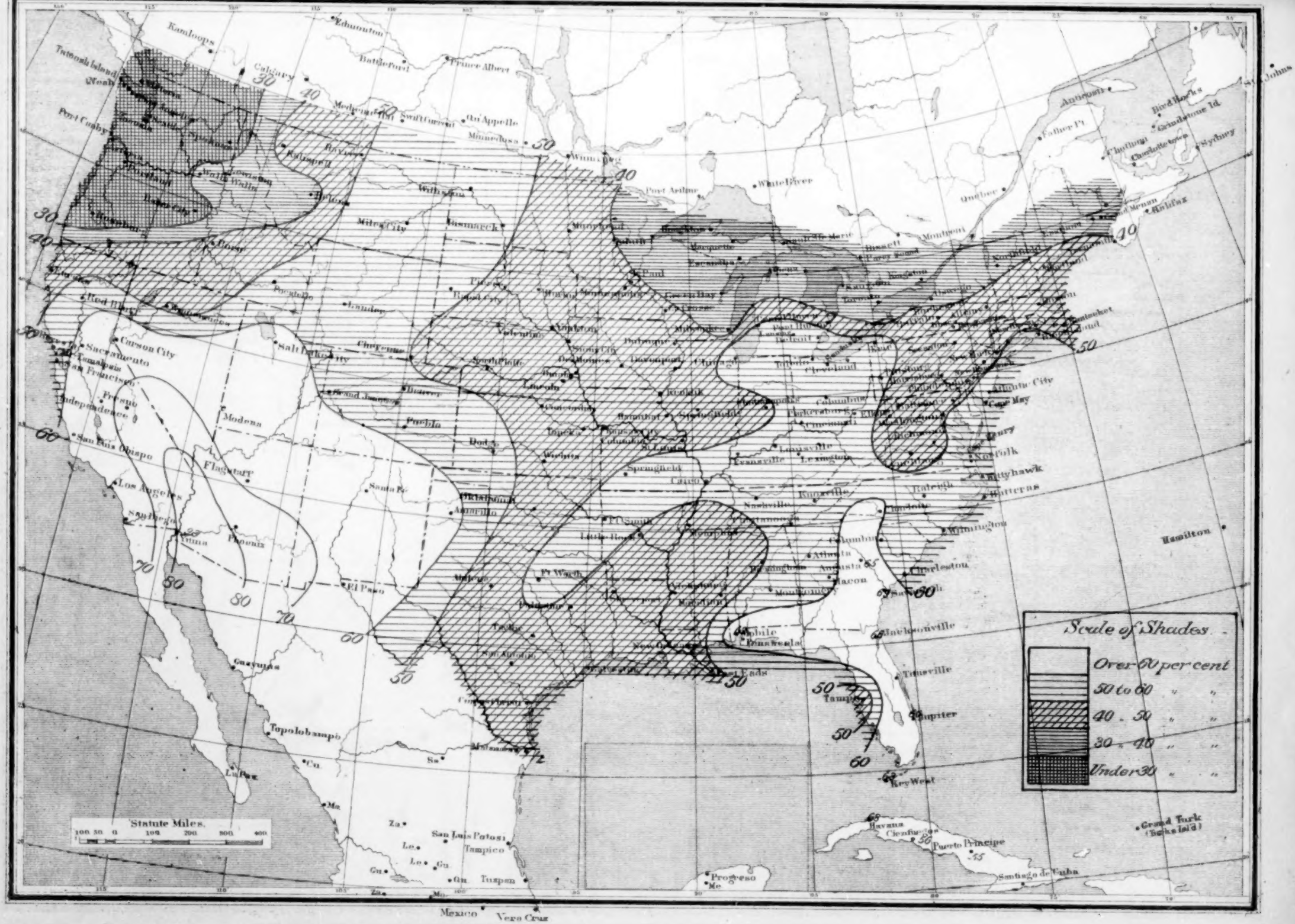
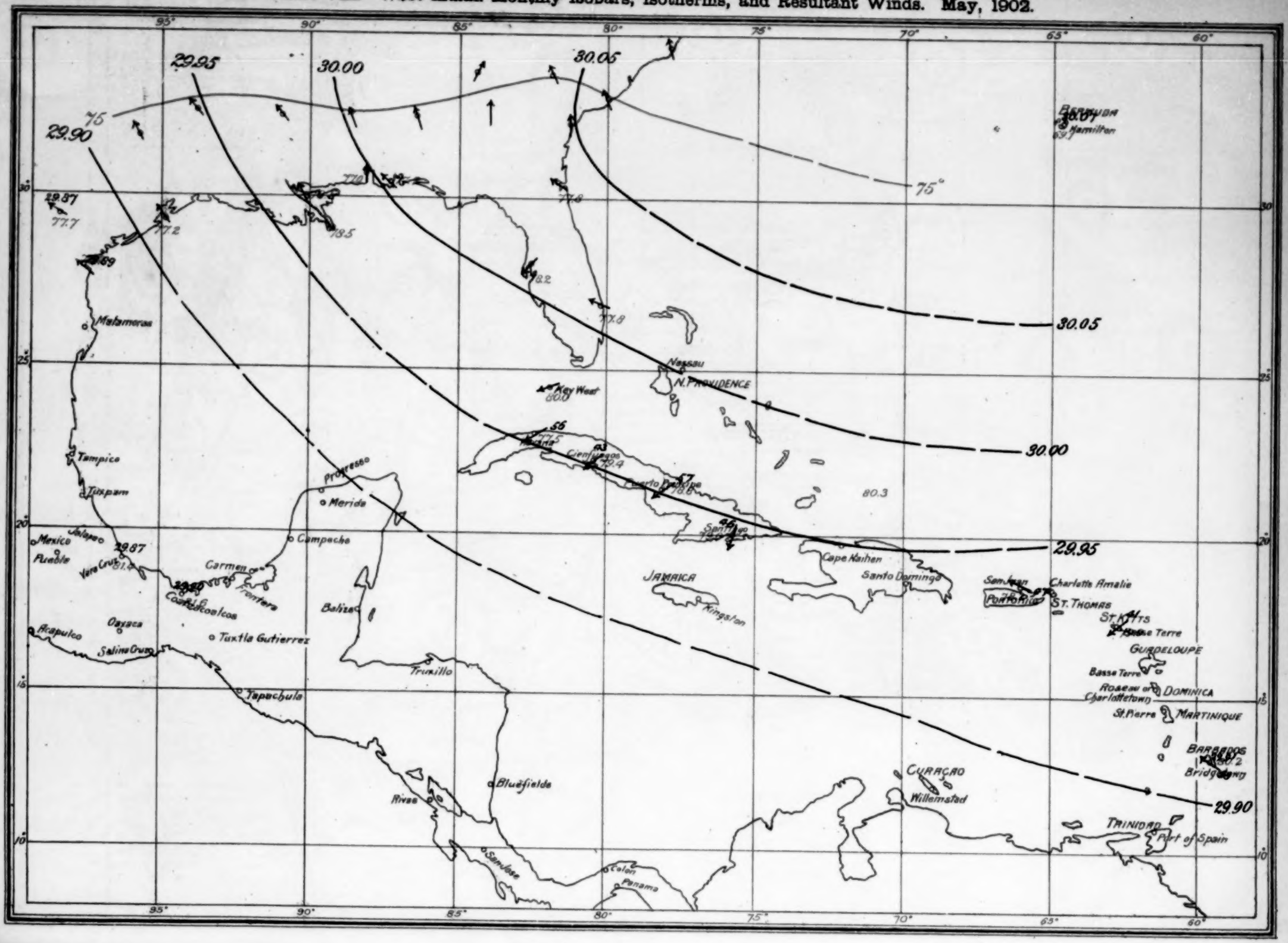
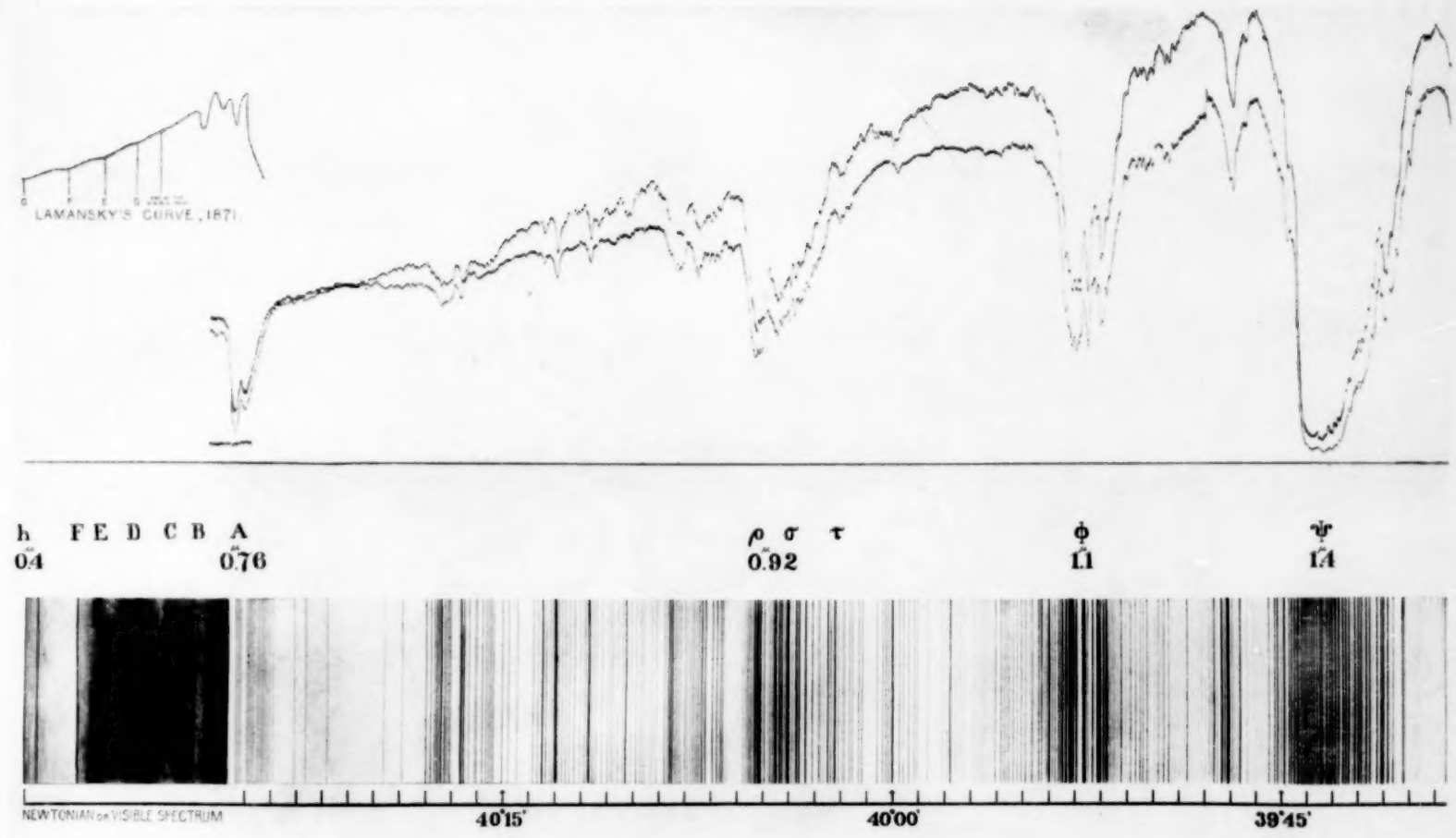


Chart VIII. West Indian Monthly Isobars, Isotherms, and Resultant Winds. May, 1902.




LAMANSKY'S CURVE, 1871
h F E D C B A ρ σ τ φ ψ
0.4 0.76 0.92 1.1 1.4
NEWTONIAN or VISIBLE SPECTRUM
40°15' 40°00' 39°45'
SLIT WIDENED
SLIT WIDENED
Ω w1w2 X x1 x2 Y
1.8 2.6 4.4 5.3
39°30' 39°15' NEW SPECTRUM 39°00' 38°45'

THE INFRA-RED SOLAR SPECTRUM OF A 60° ROCK-SALT PRISM. ENERGY CURVES AND LINE SPECTRUM FROM BOLOGRAPHS OF 1898.

OBSERVATIONS OF S. P. LANGLEY WITH THE ASSISTANCE OF C. G. ABBOT.

HELIOTYPE CO., BOSTON.